Metal Finishing

POLISHING AND BUFFING · BARREL FINISHING · CLEANING
PLATING · ANODIZING · RUST PROOFING · LACQUERING & ENAMELING

DECEMBER, 1958

CONTENTS:

Polishing and Buffing of Aluminum
Production Methods Described

Effects of Impurities in a Bright Nickel Bath on the Covering Power of a Chromium Bath
Results of Investigation

Automation Painting in Russian Machine Tool Manufacturing
A Report on Current Practice

Pumps and Their Uses in Spray Painting
Positive Displacement Types

Finishing Zinc Base Die Castings
Procedures for Optimum Results

Stripping Metallic Coatings
Formulas and Procedures

Iron Analysis in Chromium Solutions
EDTA Titration

Finishing Pointers
Technical Control Data

Science for Electroplaters
Amines

Complete Contents Page 41

Read and pass on—

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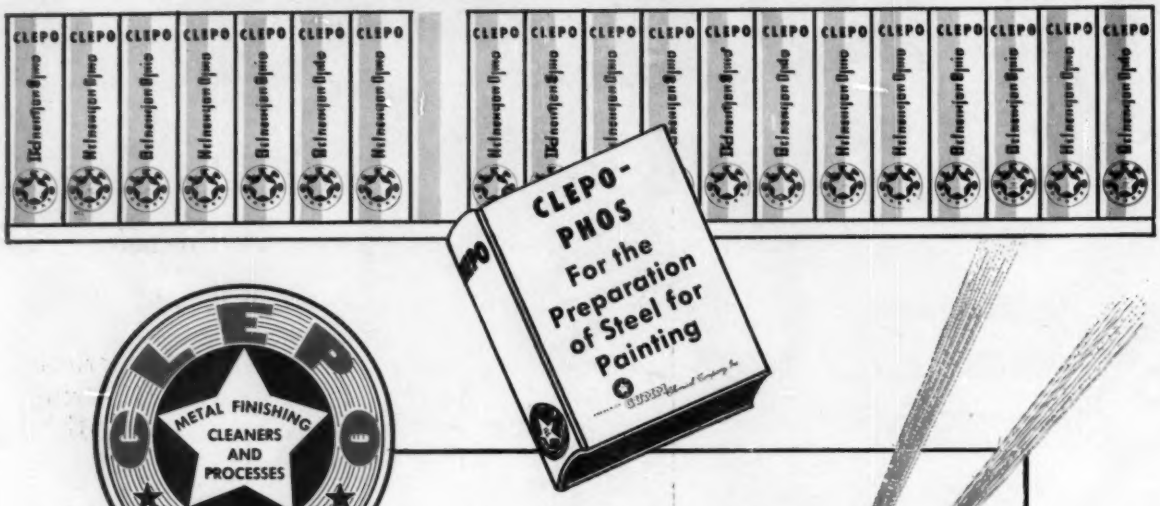
LIBRARY OF CLEPO SERVICE



CLEPO
METAL FINISHING CLEANERS AND PROCESSES

Clepo-Phos *Conditions* STEEL WHILE IT CLEANS

Reduces Foaming and Scaling to a Miniumum

CLEPO-PHOS so conditions the surface of the steel to be painted that it will anchor the coating firmly to the surface. Unconditioned surfaces produce poor bond, whereas a CLEPO-PHOS conditioned surface produces a lasting bond with the paint.

While this distinctive conditioning is of paramount importance, other operational values of CLEPO-PHOS should not be overlooked:

1. CLEPO-PHOS has excellent cleaning qualities.
2. CLEPO-PHOS is a low-foaming chemical, thus eliminating the need for adding anti-foaming agents from time to time.
3. CLEPO-PHOS does not tend to cake-up on coils or tank walls.

And CLEPO-PHOS is a 'one operation' formulation. It cleans and conditions simultaneously at exceptionally low cost. You should try CLEPO-PHOS in your production. Order a good workable test sample. Meanwhile discuss your pre-paint cleaning and conditioning problems with our Field Service Man. His experience and knowledge of the problems should be helpful.

• • •

CLEPO-PHOS is only one of many, many chemicals developed by our research staff which combines technical skill and sound, practical knowledge of your industry's requirements. CLEPO stands for technical service as well as for quality products.

FREDERICK GUMM *Chemical Company Inc.*

538 FOREST STREET, KEARNY, N.J.

How to make plating upon aluminum an exact science: For many years, hundreds of manufacturers have been using Alumon,® an Enthone process, to prepare aluminum alloys for electroplating. Enthone chemists work out the plating cycles, give in-the-plant assistance. Alumon is an easy process to use and it costs less than ½¢ per square foot of surface plated! Write for literature about this economical and efficient process. Also find out about Etchalume,® Weldal,® and other specialized Enthone compounds for finishing aluminum. Enthone, Inc., 442 Elm Street, New Haven 11, Connecticut.

ENTHONE

ENTHONE, INC. IS A SUBSIDIARY OF AMERICAN SMELTING AND REFINING COMPANY

Three stages in the finishing of a zinc base die casting. Casting at left was buffed. Center casting was buffed and electrocleaned in Oakite 195. Casting at right was buffed, electrocleaned in Oakite 195, and plated. Note that center casting retains full buffed lustre and color after its electrocleaning in Oakite 195.

New electrocleaner for zinc die castings assures brighter plate... and cuts rejects!

Plating of zinc base die castings now becomes a more dependable, more economical operation with the introduction of Oakite 195, a *non-etch* anodic cleaner.

More dependable because the casting surface is not etched and its color not changed or darkened. Soils and films are effectively removed, yet the castings retain their buffed lustre. To help further in preparing the way for uniformly good plating results, this new electrocleaner has excellent rinsability in hot or cold water, and low foaming tendency.

And more economical by far, because of the sharp reduction in rejects due to poor pre-cleaning.

Oakite 195 can be used with direct, reverse and periodic reverse current, in still tanks and fully automatic set-ups. Where only a single solution tank is available, it is being used to clean a variety of metals —zinc, steel, brass, copper.

For more information about this important new development in cleaning before plating, write for descriptive folder F-10466 to Oakite Products, Inc., 18 Rector Street, New York 6, N. Y.

SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS · METHODS · SERVICE
SCIENCE
in our 50th year

Export Division Cable Address: Oakite

Technical Service Representatives in Principal Cities of U. S. and Canada

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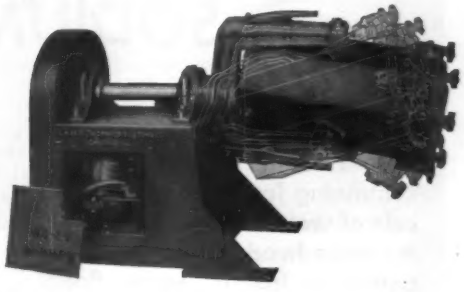
For 59 Years ...L'HOMMEDIEU...

year after year has manufactured Reliance Plating, Polishing Equipment, Supplies for Better and More Profitable Metal Finishing

No. 18 — VARIABLE SPEED POLISHING LATHE

Independent spindles—each with separate patented Variable Speed Drive and controls — ball-bearing throughout. Powered by two up to 15 H.P. motors. Adopted by leading manufacturers as standard equipment.



TYPE L — DOUBLE ACTION BARREL For ABRASIVE TUMBLING or BALL BURNISHING

The cylinder can be operated at an angle for producing a double tumbling action—thus producing a better and more uniform finish in a much shorter time.

Longer pieces finished more uniformly and without bending.

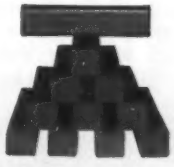
DURABILITY

PRODUCTION

ECONOMY

EFFICIENCY

RELIANCE NUWAY BUFFS FOR FAST CUTTING



RELIANCE EXTRUDED COMPOSITIONS

STANDARD SIZE 2 x 2 x 10"

THEY CUT

THEY CLEAN

THEY COLOR

THE ANSWER TO INCREASED PRODUCTION AT LOWER COSTS

Chas. F. L'Hommedieu & Sons Co.

MANUFACTURERS OF METAL FINISHING EQUIPMENT AND SUPPLIES

GENERAL OFFICE AND FACTORY

4521 OGDEN AVE. CHICAGO 23, ILL.

Chas. B. Little Co.
Newark, N. J.

W. R. Shields Co.
Detroit, Mich.

Branches:
Cleveland & Los Angeles

RELIANCE

Head start for industrial finishes

Every step toward faster, safer, more effective metal cleaning heads a company in the direction of extra profit. In the competitive race for higher quality products, produced faster, the company that crosses the "finish line" first is the one that gets a healthy start by keeping abreast of the latest developments in the industry. This series of chemical news reports will keep you posted on what's new in the chemistry of metal cleaning.

You may wish to check certain items in this advertisement and forward to those concerned in your own company.

Route to:

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FORMULATORS SHAVE COSTS WITH SODIUM ORTHOSILICATE

Alert formulators are saving freight dollars on Dow's S.O.S. containing less than one molecule of water of hydration. And the open-head Dow drum rides better in transit, saves floor space in shipping and storage.

Because it contains less than one molecule of water of hydration, Dow S.O.S. saves formulators freight costs on every drum. The almost complete absence of water means that freight dollars are spent on S.O.S.—not on unnecessary water.

High acid capacity and high pH of Dow S.O.S. give top cleaning action. Oils, fats and waxes disappear from metal like magic when exposed to the cleaning action of this efficient alkali. Experienced formulators depend on Dow S.O.S. and Caustic Soda to make their metal cleaning compounds the best on the market.

Formulators get another bonus in Dow alkalies—the improved open-head drum. It practically eliminates the headache of freight claims and shipping damage. And formulators find many uses for these smooth-riding, damage-free drums.

The Dow full open-head steel alkali drum takes up almost a full square foot less floor space than conventional drums and has a longer bearing surface which eliminates "climbing" of drums in shipment.

These advantages put Dow's formulator customers in a better competitive position . . . enable them to give *their* customers the best alkali cleaning compounds.

A basic producer of alkali for top quality metal cleaning compounds, Dow is constantly at work improving not only product quality but packag-

Formulators use Dow Alkalies to make topnotch metal cleaning compounds.

Dow chemicals basic to the metalworking industry

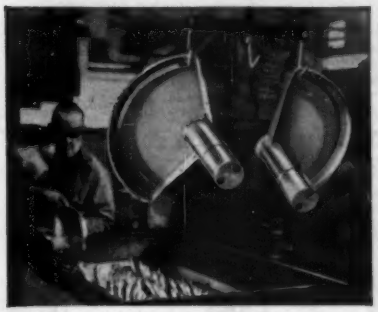
Chlorinated Solvents • Brominated Aliphatics • Alkalies • Ion Exchange Resins • Glycol Ethers • Preservatives • Hydrochloric Acid • Phenolsulfonic Acid • Ammonia • Industrial Glycols • Polyethylene Glycols • Polypropylene Glycols

ing. "Just to be sure," as one Dow product manager put it, "that the formulators who want the best come to us."

DOWANOL:

Passes "acid test" in rust removers

Metal cleaners who use a hot bath (170°F.) of phosphoric acid type rust removers are switching to Dowanol® TPM for their glycol ether solvent.



Dowanol helps rust removers do a better job.

Dowanol TPM (tripropylene glycol methyl ether) gives better solubilizing and penetrating characteristics and, because of its high boiling point (238°C.), does not readily evaporate under extremely high bath temperatures.

In brush and spray rust removal operations, as well as dip baths, Dowanol TPM is helping phosphoric acid removers do a better job at lower cost.

Dowanol TPM is only one of the Dowanol family of glycol ether solvents made by Dow (only company which makes both an ethylene and propylene series). Producer of the widest line of glycol ether solvents available, Dow is in a position to furnish extensive technical information on these products for metal cleaning operations.

★ ★ ★ ★

For more information on any of the chemicals discussed in this advertisement write THE DOW CHEMICAL COMPANY, Midland, Michigan, Chemicals Sales Department 763F-1.

YOU CAN

DEPEND ON

DOW

CHLOROTHENE:

Puts more solvent power, more safety into cold cleaning

Maintenance cleaning of metal parts calls for a solvent with top cleaning power, maximum safety and little or no residue. And Chlorothene® (Dow 1,1,1-trichloroethane, inhibited) fills the bill.

Plant maintenance men are using this new solvent to get better, safer cleaning in dip, spray and wipe applications. They're cleaning everything from nuts and bolts to big machine tools.

Many plants switched to Chlorothene because management was sensitive to safety factors. But once in use, Chlorothene proved itself as a top-performing cleaner, made other cleaners just plain out of date.

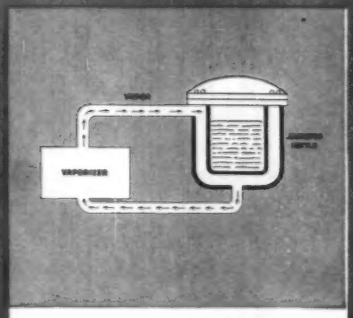
Because it is low in toxicity and has no flash or fire point (flammability characteristics similar to trichloroethylene), Chlorothene is quickly catching on for production cleaning as well as maintenance cleaning operations.

MORE GOOD NEWS

for the metalworking industry

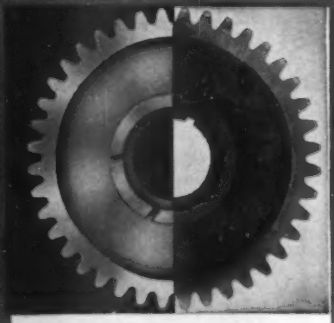
Orthodichlorobenzene

. . . Tops for removal of soft carbon deposits as well as oils and tars. Cost savings possible with water soluble emulsions — formulations available on request.



Dowtherm®

. . . Safer, organic heat-transfer medium for operations ranging from 300° F. to 750° F. Minimizes fire hazards, permits economical, pinpoint heat control, with little pressure!



Trichloroethylene

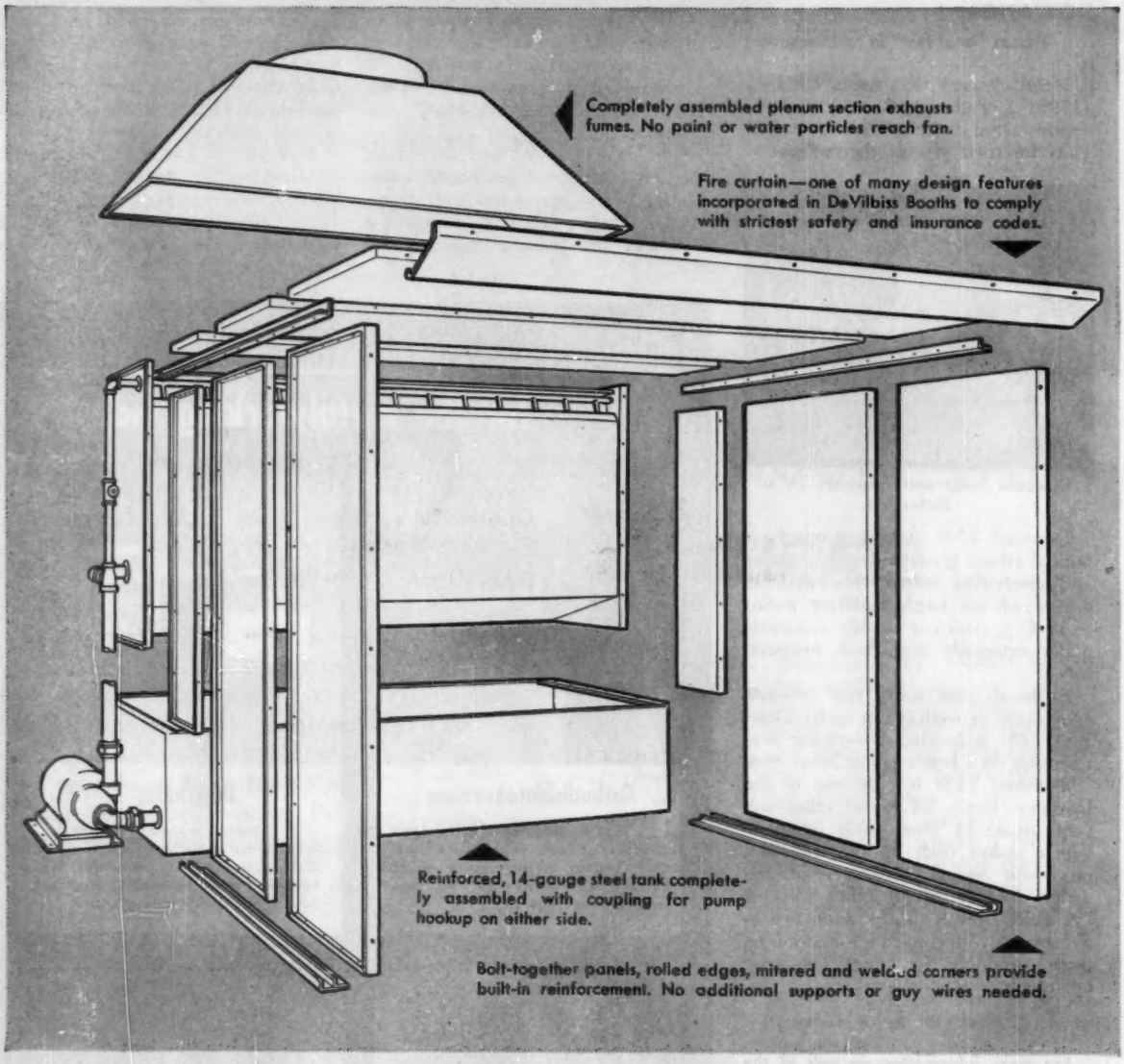
. . . Now NEU-TRI* (recently added neutral grade) gives Dow customers a full line of solvents to choose from for top efficiency in vapor degreasing.

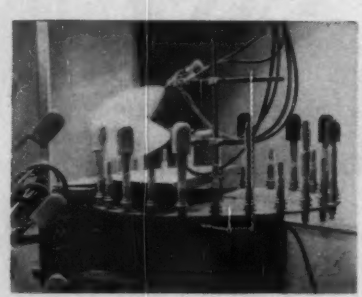
*TRADEMARK OF THE DOW CHEMICAL COMPANY

Dowicide® A

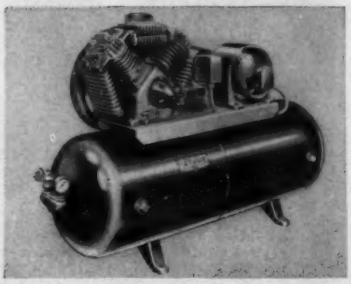
. . . Preservative keeps cutting oils "fresh" and odor-free by preventing growth of bacteria and mold. Makes oil last up to three times as long.

How DeVilbiss Standardized Spray

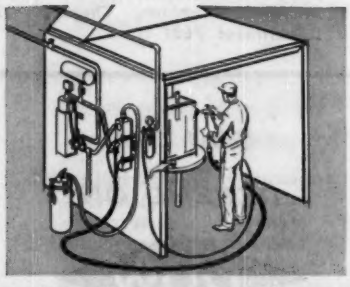

Completely assembled plenum section exhausts fumes. No paint or water particles reach fan.
Fire curtain—one of many design features incorporated in DeVilbiss Booths to comply with strictest safety and insurance codes.
Reinforced, 14-gauge steel tank completely assembled with coupling for pump hookup on either side.
Bolt-together panels, rolled edges, mitered and welded corners provide built-in reinforcement. No additional supports or guy wires needed.



DeVilbiss Automatic Spray Machines coat products of any size or shape quickly, economically, automatically.
Send for Series I-8000 Bulletins

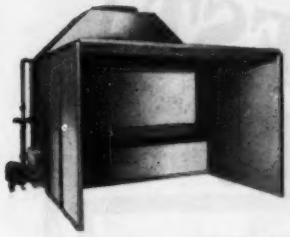


DeVilbiss Air Compressors deliver as much as 22.6% more air per power dollar. Sizes range from ½ to 25 hp.
Send for Catalog C-50



DeVilbiss Hot Spray. Provides heavier film build, with faster drying, less overspray, and fewer rejects.
Send for Bulletins IE-114B and F-286

Booths save assembly costs



Prefabricated parts bolt together to form a rigid, self-supporting structure. It's quick, easy! Wide selection of sizes and types

More value for your spray-booth dollar. DeVilbiss "ready-made" booths can be assembled quickly and economically by simply bolting standardized parts together; are easily modified to meet future needs. Mass-produced panels, accurately sized and punched, are self-reinforcing . . . form a rigid, free-standing structure. Snug fit provides a smooth, easy-to-clean interior surface.

DeVilbiss Spray Booths have outstanding design and construction features that are responsible for their high paint-trapping efficiency, their ease of installation. And you save on operating costs, too. Perfected design principles reduce power consumption of fans and pumps. Booths stay cleaner longer; require less maintenance time and expense.

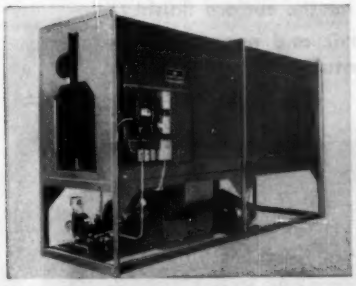
They are manufactured to the standards of the National Board of Fire Underwriters for spray booths as recommended by the National Fire Protection Association.

Selection and delivery are no problem, either. In most cases, one of over 500 standard sizes and combinations will fit your needs. But should you require equipment for a special installation, or help in selecting and pricing components, a DeVilbiss representative will be glad to work with your engineers at no cost or obligation.

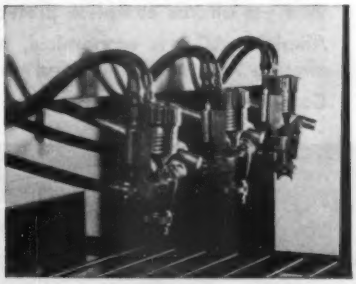
PLUS VALUE: At DeVilbiss, you deal with the *only* one-source designer and manufacturer of completely engineered finishing systems or individual components. Call your nearest branch office, today. Or write for a copy of the Spray Booth Catalog I-7000 containing handy selector guide.

DEVILBISS

THE DEVILBISS COMPANY, Toledo 1, Ohio • Detroit, Michigan • Barrie, Ontario • London, England • Branch Offices in Principal Cities



Continuous process ovens. Designed and manufactured to meet layout and production needs for baking or drying. *Send for Oven Catalog*



DeVilbiss Automatic Guns spray all coatings accurately, uniformly; insure better finishes at lower cost. *Send for Catalog I-1125A*

DeVilbiss Fluid Hose. Unsurpassed for resistance to solvents, oils. Flexible, kinkproof. Full line of connections. *Send for Catalog IE-E.*

ANOTHER NORTHWEST FIRST!

...completely NEW concept in metal cleaning!

- An easy handling liquid.
- Effective on *all* metals.
- Requires NO special tanks or equipment.
- A completely organic product.
- Won't injure rack coatings or work finish.
- Simple positive control.

Alkalume LC-1 is a specially developed immersion-type cleaner for removal of buffing compounds and soil from all metals, prior to plating or anodizing.

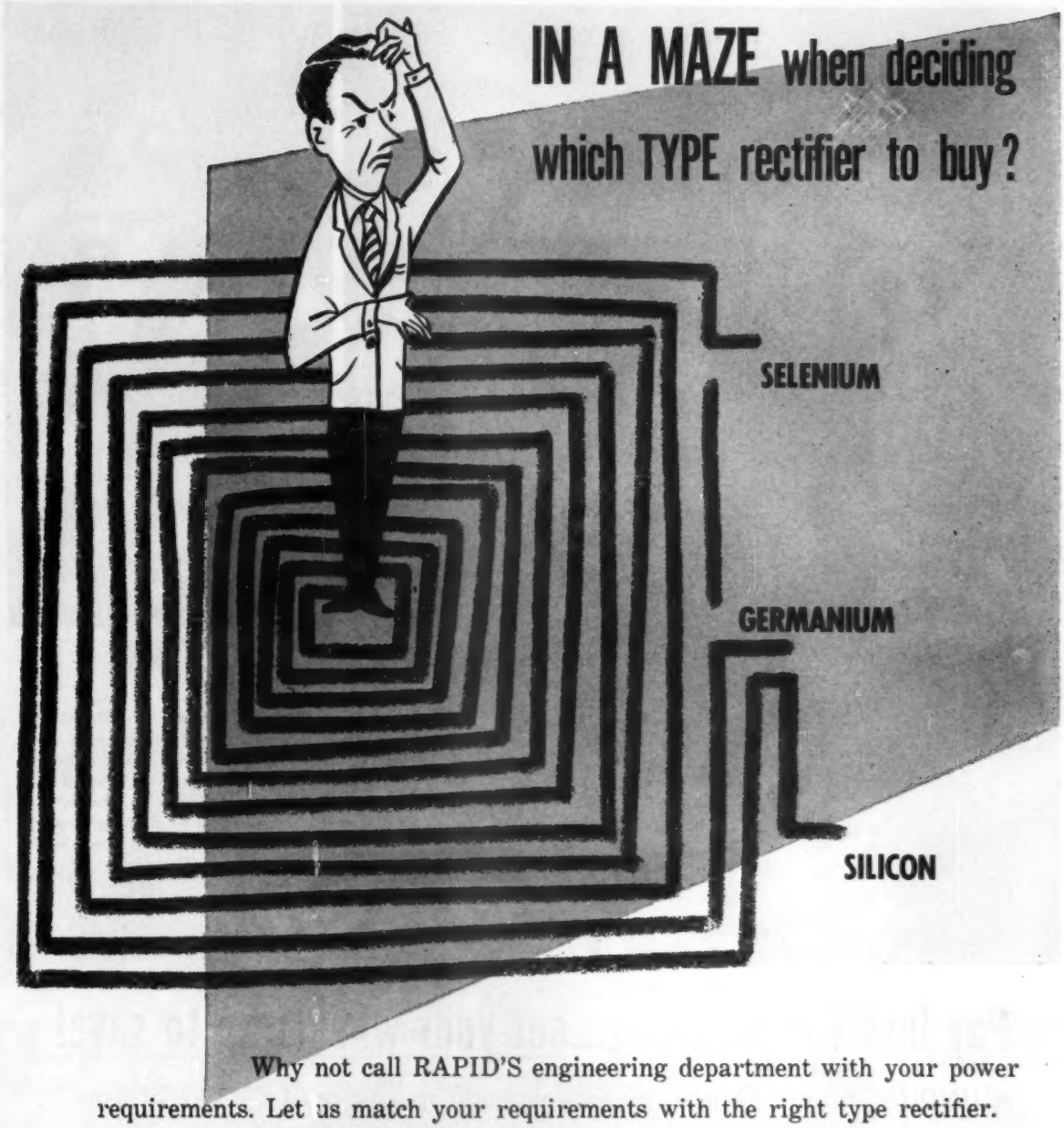
It is non-solvent, non-alkaline and not an emulsion. It has the desirable penetrating properties of both alkali and solvent yet affords complete protection for the surface finish.

Alkalume LC-1 is economical, non-toxic and non-volatile, offering long service life and no disposal problem.

Complete details upon request.

The name NORTHWEST means first with the best!

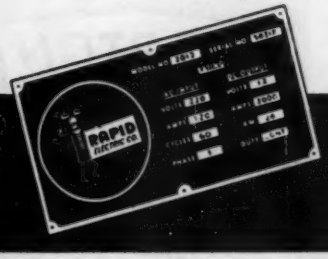
LO-HI pH



Why not call RAPID'S engineering department with your power requirements. Let us match your requirements with the right type rectifier.

Because each semi-conductor has advantages to offer, and because RAPID supplies *all three*, you can be certain of obtaining sound technical advice.

Call TA 8-2200 for reliable technical service.



THE NAMEPLATE THAT MEANS *"More Power to You!"*

RAPID ELECTRIC COMPANY

12838 Fenkell Avenue • Detroit 27, Mich. • Diamond 1-8537

2881 Middletown Road • New York 61, N. Y. • TAlmadge 8-2200

Wheels coated with ALUNDUM abrasive give housing covers a high polish faster and for less money. Setting up the wheels, as shown, is an easy job. The high capillarity of this polishing grain improves and speeds up the wetting process with glue or cement.

Pay less for polishing...set your wheels up to save!

ALUNDUM abrasive brings you the value-adding, cost-cutting "Touch of Gold"*

Norton abrasives are first choice in many plants for better results at lower costs, in the widest range of polishing jobs.

Where especially long life is desired, the blocky shaped E_1 ALUNDUM B abrasive is extremely popular. Available in grit sizes 14 to 240. Where faster cutting action is required E_{132} ALUNDUM S abrasive (sizes 14 to 90) or E_{128} ALUNDUM R abrasive (sizes 100 to 240) are first choice. All three types are specially treated to give much greater adhesion with glue or cement. Typical advantages common to all ALUNDUM polishing grains include:

- *Uniform grain shapes*, which assure fast, uniform cutting action.
- *Uniform grain sizings*, with no oversize grains that mar the finish, no undersize grains to loaf on the job.
- *High capillarity*, assuring the easy absorption of adhesive that means longer lasting, better performing set-up wheels.

The booklet "Setting Up Metal Polishing Wheels and Belts" contains valuable facts on the various types of ALUNDUM abrasive . . . on the applications of canvas, leather or wooden wheels . . . and on the best means of preparing wheels, with cement or glue. Ask your Norton Distributor for it. Or write to NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors around the world.

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

NORTON
ABRASIVES

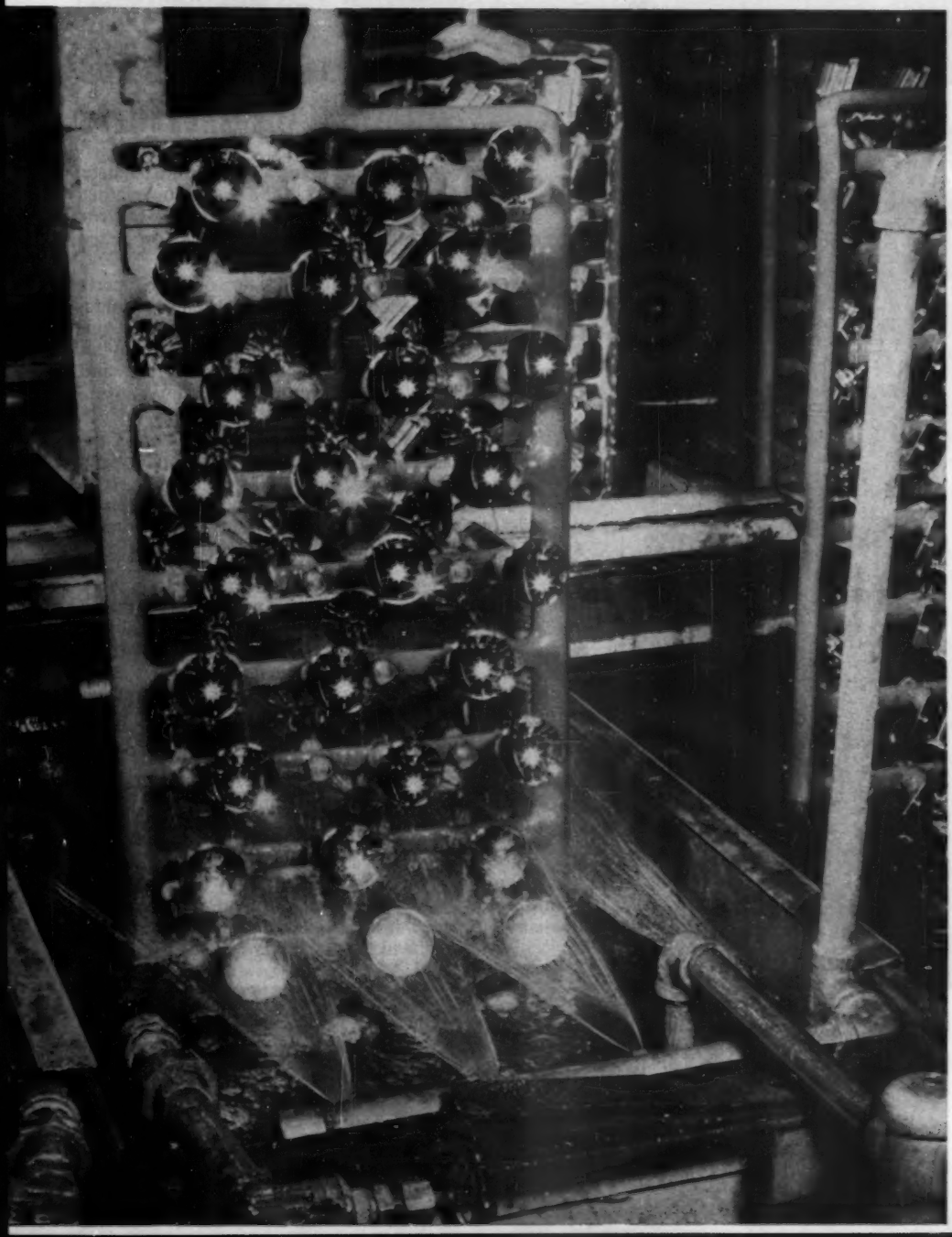
G-354

Making better products . . . to make your products better

NORTON PRODUCTS Abrasives • Grinding Wheels • Grinding Machines • Refractories • Electrochemicals — BEAR-MANNING DIVISION Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

Get the extras that cut costs and guarantee consistent results... Competitively tested materials, comprehensively and conscientiously serviced by a nationwide network of sales engineers and distributors. Federated's materials include new ASARCO-MAX COPPER anode, triple-life Conducta-Core lead anode, copper, zinc, tin, tin-lead, cadmium, brass and silver anodes. Nickel salts. Zimax, Nimax, Cadmax brighteners. New Conmax conversion coatings for zinc and cadmium plated parts. Federated Metals Division of American Smelting and Refining Company, 120 Broadway, New York 5, N. Y. In Canada: Federated Metals Canada, Ltd., Toronto and Montreal.

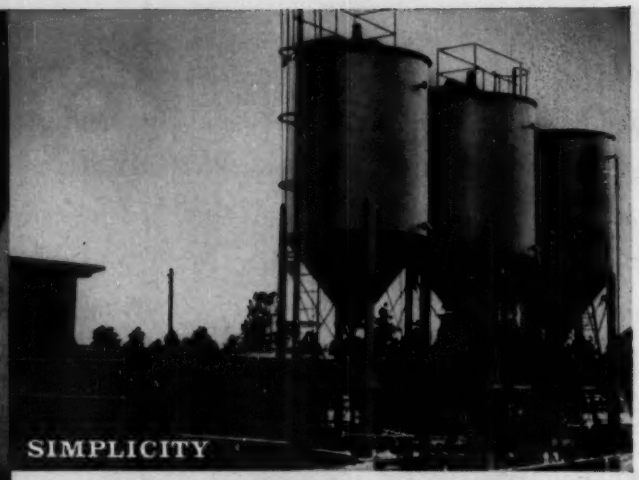
FEDERATED METALS DIVISION OF



ASARCO

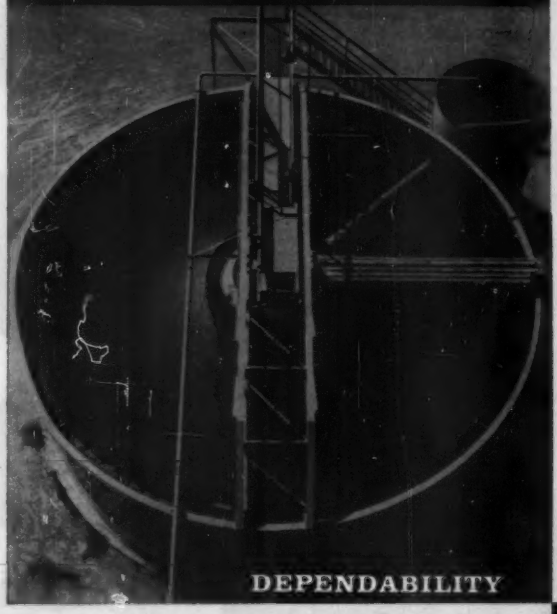
AMERICAN SMELTING AND REFINING COMPANY

SAVINGS



SIMPLICITY

IN WASTE TREATMENT FOR THE PLATING INDUSTRY



DEPENDABILITY

GRAVER Offers

SAVINGS • SIMPLICITY • DEPENDABILITY

SAVINGS in a TV antenna plant. Graver ion exchange system results in savings of $2,000 a month on plating operation through elimination of bath dumping. System restores original bath quality and provides for better rinsing.

SIMPLICITY in a missile plant. Plating of missile parts requires over 10 processes resulting in chrome, cyanide, acid and alkali wastes. These wastes are collected from 120 plating tanks into three streams and treated by an integrated Graver plant providing for destruction and reduction of wastes. Central control board, simple operating charts keep operator time to a minimum.

DEPENDABILITY in an electronic controls plant. Cyanide, chrome, acid and alkali are treated separately and then sent to a Graver Reactivator® for complete precipitation of metals from water. Positive clarification is achieved on every load, as it has been since the treatment system was installed more than two years ago.

Your waste treatment plant can incorporate all three advantages. Perhaps no recovery is possible or desirable at your plant, yet you still get simplicity and dependability and save because of them through low requirements on equipment, time, labor and maintenance. Perhaps automatic operation is not indicated, yet with Graver you still get the simplest operating plant possible plus the other advantages. Graver offers equipment for all types of plating waste treatment in a wide range of industries. Our experience and the high quality design and construction of our units assure the most advantages in your waste treatment plant.

Request literature! Tell us about your plating problem and we will send you a case history study of how a similar problem was solved and how one plant, representative of many, benefited from Graver's trio of advantages—savings, simplicity and dependability.

GRAVER

Industrial Waste Treatment Dept. W-523
GRAVER WATER CONDITIONING CO.
Division of Union Tank Car Company
216 West 14th Street, New York 11, N. Y.

It takes both know-how and quality chromic acid to produce quality plating...

that's why

MUTUAL

tests every drum...

The uniform, high quality of Mutual Chromic Acid – that teams with the plater's skill to produce premium plating results – is insured by our testing the contents of *every* drum before shipment.

When you order Mutual Chromic Acid, you know the product you get is always 99.75% pure – or better. Sulfate content never exceeds 0.1% to permit more accurate control of the acid-sulfate ratio in the bath.

A booklet "Mutual Chromium Chemicals," contains technical information on chromic acid and our entire line of Mutual products.

Mutual chromium chemicals

Sodium Bichromate
Sodium Chromate
Chromic Acid
Potassium Bichromate
Potassium Chromate
Ammonium Bichromate
Koreon (one-bath chrometan)

SOLVAY PROCESS DIVISION
61 Broadway, New York 6, N.Y.

Allied Chemical

MUTUAL chromium chemicals are available through dealers and SOLVAY branch offices located in major centers from coast to coast.

Solvay Process Division
Allied Chemical Corporation
61 Broadway, New York 6, N. Y. Dept. 9-12

Please send me Bulletin #52—"Chromium Chemicals."

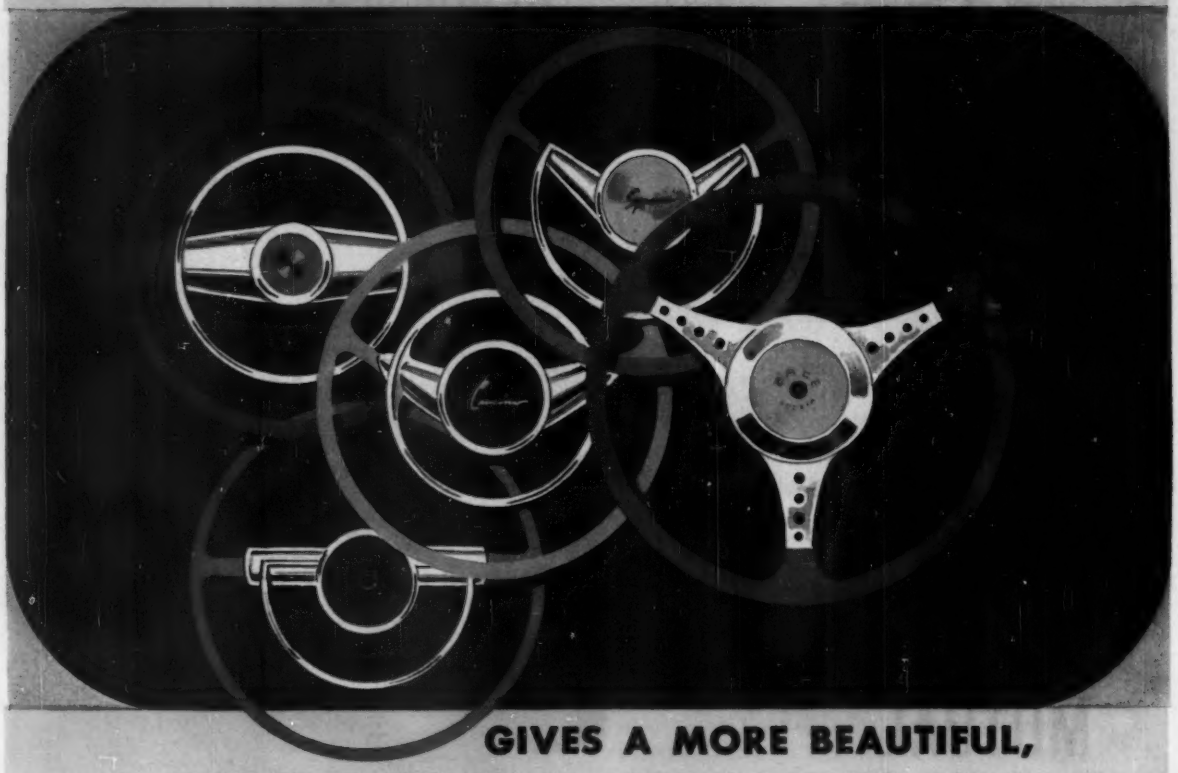
NAME_____ TITLE_____

COMPANY_____

STREET_____

CITY_____ ZONE_____ STATE_____

BRIGHTER COPPER, LESS TIME
with ISO-BRITE™ Addition Agents



GIVES A MORE BEAUTIFUL, DURABLE PLATE AT LESS COST TO YOU!

Whether you're producing plated parts for use on your own products or selling plated parts to volume buyers, your customers' "OK" of your plated finish is of first importance to you! Equally important is being able to do a first-rate job at the lowest possible cost. That's why the proved advantages of ISO-BRITE Copper Process are doubly important.

Now available from Allied Research — ISO-BRITE Copper Gives You:

ECONOMY—Freedom from roughness that reduces scrap. Deposit is fine grained, dense, ductile, and fully bright; requires no buffing. The high anode efficiency and wide operating temperature range, 135-165° F., are bonus qualities.

SPEED—Faster rate of deposit cuts time in tank—or gives you heavier plate for equivalent tank time.

EASE OF CONTROL—Requires less maintenance than any other copper bath. Noted for its high tolerance of organic contamination.

BEAUTY—DURABILITY—Provides fine-grained, dense deposit that assures the finest finish. ISO-BRITE beauty is more than skin deep. No rough, porous copper to try to disguise.

Teamed up with the strong advantages of ISO-BRITE Copper is the systematized approach to your copper plating problem, resulting in a sludge-free bath. This includes bagging using exclusive weaves and materials, containers of vertical wire construction and FLAT-TOP anodes.

We study your problem and make specific recommendations tailored to your installation.

For complete information or assistance, simply get in touch with the Allied Field Engineer, listed under "Plating Supplies" in your classified 'phone directory.

NOTICE: **All Wagner Brothers products, facilities, personnel and know-how are now available to you from Allied Research.**

Allied Research Products, Inc.

4004-06 EAST MONUMENT STREET
BALTIMORE 5, MARYLAND

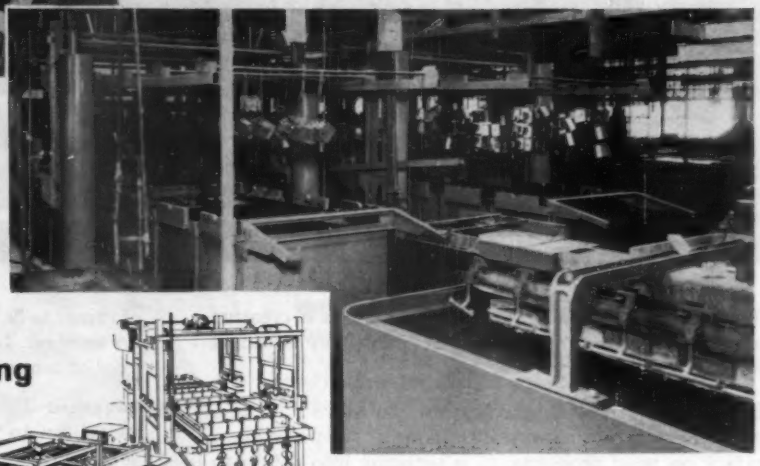
BRANCH OFFICE: 400 MIDLAND AVENUE, DETROIT 3, MICH.

Wagner

CHEMICAL AND ELECTROCHEMICAL PROCESSES, ANODES, RECTIFIERS, EQUIPMENT AND SUPPLIES FOR METAL FINISHING

BELKE Automatic Pre-plate processing

cuts costs so much that few job platers can compete with others unless they have it.

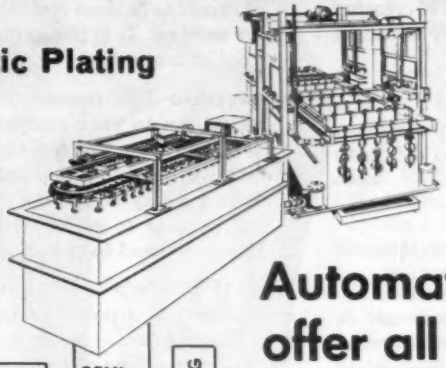


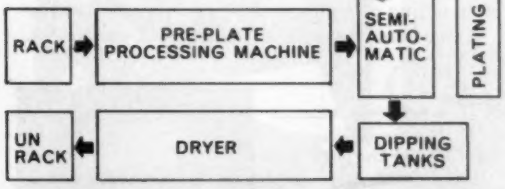
Above—Loading end of automatic processing machine. Plating racks loaded with work are hooked to removable rods. The machine advances each rod automatically from tank to tank at precisely timed intervals.

At Right—Unloading end of automatic processing machine. The racks of processed work are transferred to semi-automatics or still plating tanks.

Flexible Automatic Plating at LOW COST

For big production of high quality plating with varied work many plants use arrangements like this: 1) The automatic processing machine, 2) A combination of semi-automatics and still plating tanks as required by the variations in their work, 3) Dipping tanks, and 4) dryers suitable for drying racked work (Fig. 1)





Installations like the above afford complete cleaning, plating and drying from start to finish with one racking—Flexibility is retained as needed. Handling is minimized, walking is eliminated. Cost reduction is tremendous.

Typical pre-plate cycles with the BELKE Automatic Transfer Unit

Removal of carbon smuts, oxide smuts, buffing and drawing compounds, grease and oil from: 1) steel, 2) malleable and grey iron castings, 3) brass, bronze and copper, 4) brass, bronze, copper and steel in the same cycle, 5) die castings, 6) electrolytic descaling of iron and steel, 7) preparing aluminum for anodizing, chromadizing, painting.

*BELKE Automatic Processing Units are also used for pre-painting and other treatments that require dipping, soaking, electrocleaning, etc. Send requirement details for recommendation.

Only BELKE Automatic Transfer Units offer all these advantages:

A. Automatically processes through any required cycle.* Any processing time from 10 seconds to 20 minutes. Available in a wide range of tank sizes.

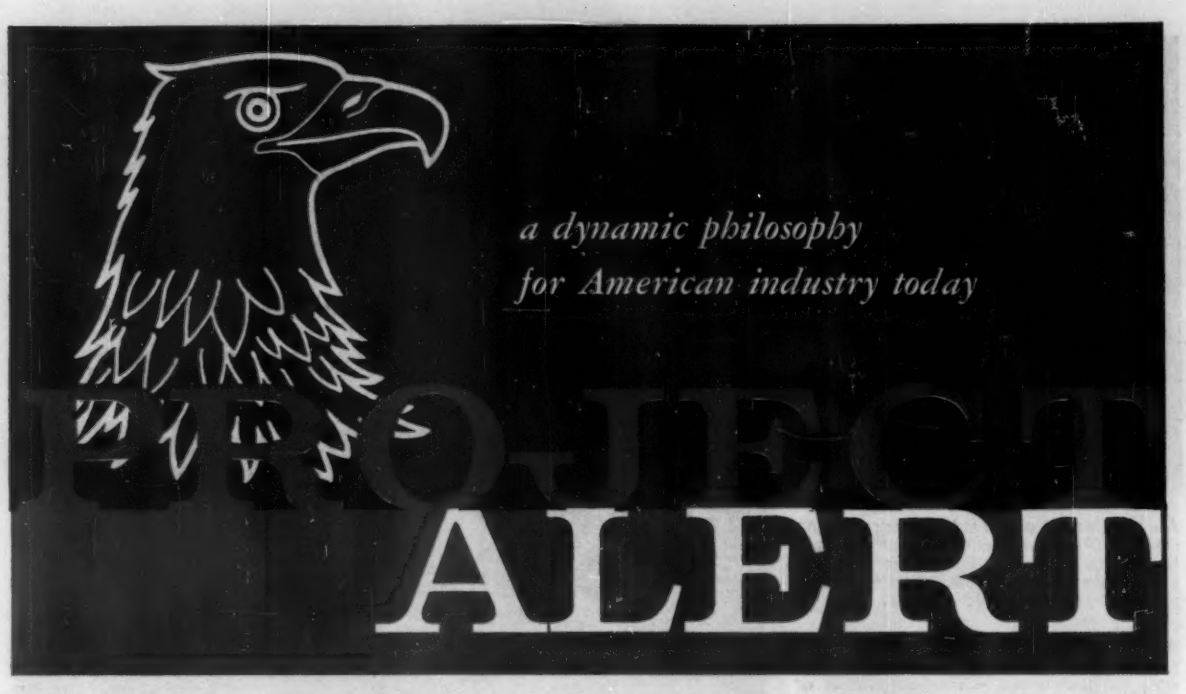
B. Easily adjusted tank "skips" permit varied processing without changing solutions — make practical automatic processing of varied work from die cast parts to steel.

C. Processing time can be varied according to requirements of the work without changing plating time — processing is not rigidly geared to plating as is true with full automatic plating machines.

D. Automatic timing standardizes processing quality and sets the pace for production with no slow down. Partially loaded rods can be seen at a glance. The superintendent can quickly see slow downs and seek the cause and remedy.

Write for literature or send details of your requirements for recommendations

Belke Manufacturing Company
947 N. Cicero Ave., Chicago 51
EVERYTHING FOR PLATING PLANTS



The purpose of this project is to establish a creative attitude of *dynamic alertness* on the part of all personnel in American industry.

Dynamic alertness is alertness on the move . . . is a positive, constructive way of thinking . . . a spirited new attack on your problems. It is swinging into action to get things done today . . . to insure a brighter, more prosperous future.

Three key words express the attitude of *dynamic alertness* . . .

1. **Observation:** This means inspiring your people to look at your problems with curiosity and creative imagination. It is taking a walk through your plant and looking at things as though you are looking at them for the first time. It is cutting through the fog of complacency and seeing things with new eyes. It is looking for new ways to stop leaks and losses; searching for new ways to speed production and efficiency.

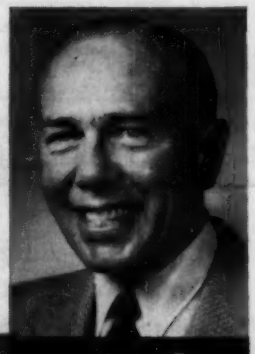
2. **Concentration:** This means the intense application of the mind power of everyone to specific problems. It is the starting of new creative fires in your organization. It is having key people ask themselves key questions: How can I do my job better? How can I speed the flow of work? How can I cut down on errors? It is applying individual and group thinking to a list of things to be done and sticking with them until they are finished. It is preparing today to solve the problems of tomorrow.

3. **Devotion:** This represents a new vital spirit of rededication to your company, to your customers, to your industry, to America. It is a return to the creative ingenuity that made this nation great . . . finding a way or making one. It is having the power and purpose to go forward, to believe in the future, to move ahead to better things.

We at Udylite believe in Project Alert. All of us, to a man, are pledged to a policy of dynamic alertness in every facet of our jobs . . . in our contacts with fellow workers . . . in the handling of equipment . . . on the production line . . . in our contacts with suppliers and customers.

C. H. Reeme, *president*
The Udylite Corporation

the udylite corporation
Detroit 11, Michigan
World's Largest Plating Supplier



Make Project Alert work for you

Apply this dynamic philosophy to your firm. New, fresh creative imagination, newer, better production methods, newer more reliable equipment applied to the job now will pay off in a brighter, more prosperous tomorrow. Write for a free copy of the Project Alert folder. It's a free Project Alert input by Udylite. There's no obligation, of course.

PROJECT ALERT

Project Alert Working at UDYLITE *Produces for You...*

SILICON EFFICIENCY, RUGGEDNESS AND LONG LIFE

for old rectifiers

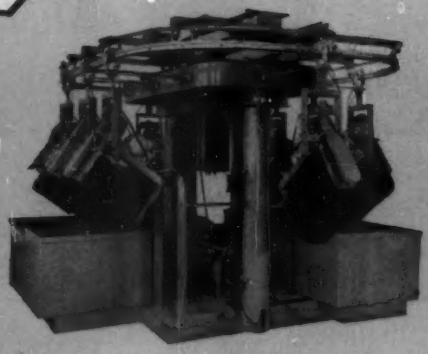
1. **A SPECIAL PRODUCT . . .** For the first time, a Udylite-engineered, Udylite-built *silicon* replacement stack is offered for you to use in revitalizing your Udylite magnesium-copper-sulphide or selenium rectifier and upgrading its performance to the level of today's best. *And you can do this in your own shop,* without delay, at a minimum of expense and down time.
2. **A SPECIAL SERVICE . . .** As an alternate plan, your old rectifier can be returned to Udylite for *factory* installation of the silicon replacement stacks by trained rectifier specialists. At the same time, your rectifier will be completely overhauled and tested so that it will be returned to you renewed and ready for the longer life and high efficiency of Udylite silicon.
3. **A SPECIAL VALUE . . .** This whole program is set up as a Project Alert. A special department will handle your order and your equipment from start to a completely satisfactory finish. A *guaranteed delivery* will keep your down time to a minimum. With prices based on a production line plan, you will get more value per dollar spent than you ever before thought possible.

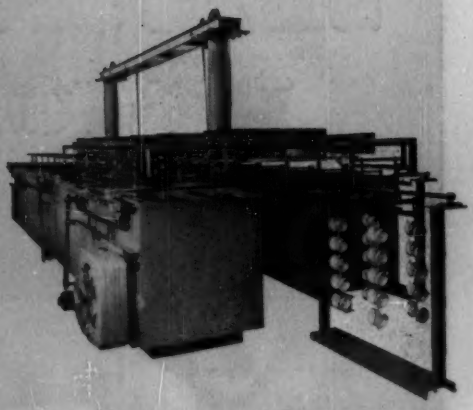
Let Udylite help you get your entire plating operation in top working order and ready to go at peak capacity. Your Udylite sales engineer will be calling on you soon. But if you need priority service, write, phone or wire directly to:

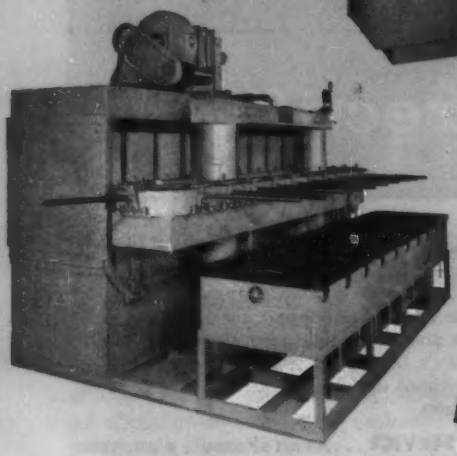
the udylite corporation

PROJECT ALERT

CROWN AUTOMATICS



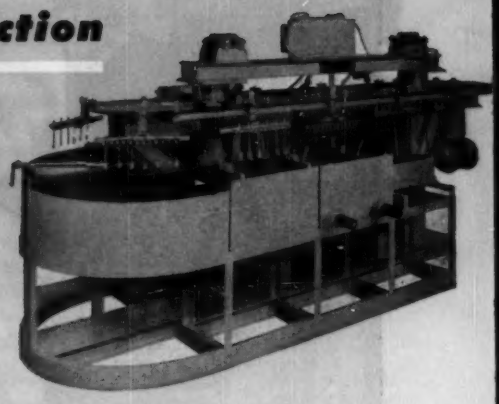


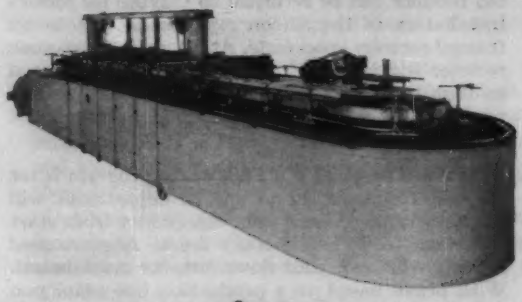


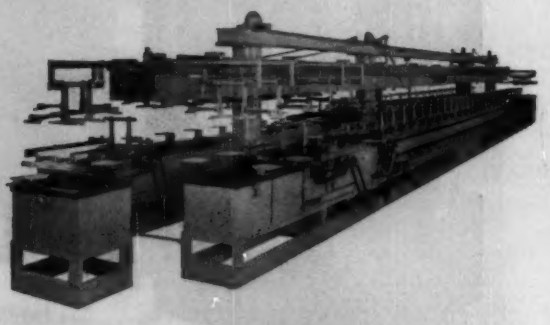
increase production

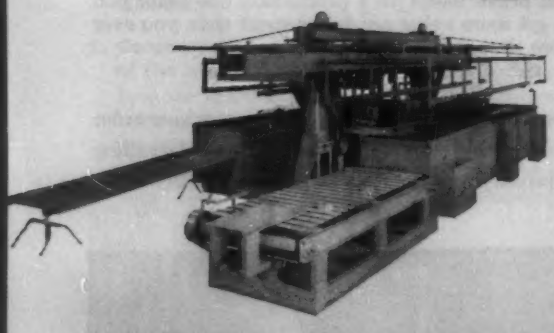
reduce costs

improve quality









Crown Automatics are ideal for plating your barrel or racked work. Crown manufactures the widest variety of fully automatic plating machines in the industry... *there is a model to fit your needs.* Write us details of your job and production requirements.

CROWN RHEOSTAT AND SUPPLY COMPANY

1965 PRATT BOULEVARD • ELK GROVE VILLAGE ILLINOIS

What! A metal-cleaning expert? Who needs one?

YOU DO... AND HERE'S WHY!

The sole function of your Wyandotte Industrial Service Representative is to help *you* in your metal-cleaning and metal-finishing operations. He is trained to show you how to use Wyandotte products most effectively – and how to cut costs at the same time!

Sound like a big order? Well, it is! But remember, your Wyandotte Industrial Service Representative is highly specialized – and his technical files bulge with knowledge gleaned from many years of coast-to-coast experience *in all phases* of metal cleaning and finishing!

What's more, your Wyandotte expert has all the advantages of product know-how and chemical research at his fingertips. This assures you of getting the very best product and the most "mileage" for your money!

So, you see, with Wyandotte you get the finest in chemical products, capable technical service backed by extensive research, and unequaled experience in metal finishing. This combination means BETTER RESULTS AT LOWER COST!

Mail the coupon in today – or call our nearest office – to arrange a date with your Wyandotte Industrial Service Representative. *Wyandotte Chemicals Corporation, Wyandotte, Michigan. Also Los Nietos, California. Offices in principal cities.*

Wyandotte CHEMICALS

J. B. FORD DIVISION

THE BEST IN CHEMICAL PRODUCTS FOR METAL FINISHING

MAIL TODAY!

Wyandotte Chemicals Corporation
Dept. 3098
Wyandotte, Michigan

Yes! Please have your Industrial Service Representative contact me regarding _____

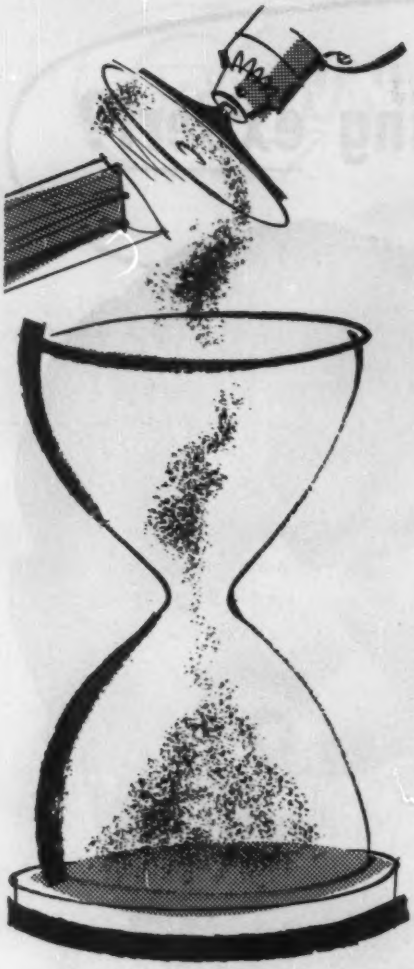
Name _____

Title _____

Firm _____

Address _____

City _____ Zone _____ State _____



Sanding time cut 38% with LOWE VINOC

Another example of the kind of cost-saving ideas you can get from an experienced Lowe Brothers finishing engineer. Here's the story:

"I suggested Lowe Vinoc when the plant superintendent complained about the sanding time required with another product. Now they save 38% in sanding man-hours by spray finishing with Vinoc, and they're well pleased with its appearance. The 38% is their figure."

Let a Lowe Brothers finishing engineer help *you* find ways to reduce costs. He knows finishes *and* methods — and he'll gladly make a "flow-chart" analysis of your finishing system if you'll send the coupon. No obligation, of course.

LOWE BROTHERS

INDUSTRIAL FINISHES

QUALITY UNSURPASSED SINCE 1870

Style-tested paints for Home and Industry

REPRESENTATIVES IN: Chicago, Ill. Boston, Mass. • Jersey City, N. J. Cleveland, Ohio • Pittsburgh, Pa. Rochester, N. Y. • Dayton, Ohio Columbus, Ohio • Milwaukee, Wis. Indianapolis, Ind. • Cincinnati, Ohio Detroit, Mich. • Springfield, Mass. Philadelphia, Pa.

The Lowe Brothers Company MF-12
Dayton 2, Ohio

☐ Please have my nearest Lowe Brothers Finishing Engineer call on me as soon as possible.

NAME_____

TITLE_____

FIRM NAME_____

ADDRESS_____

CITY_____ ZONE____ STATE_____

SUPERIOR SERVICE IN APPLICATION ...IN USE

... One of the advantages available with Unichrome Coating 218X

Applicators of Unichrome Coating 218X, located in every major area, all have what it takes to assure you *fast* service, *expert* job, *longer lasting* rack protection.

They're equipped for it ... through long metal-coating experience ... and with the right facilities. They get coatings to stick tight by using Unichrome Primer 219-PX. They build up the top coat with skill, using the coating with a 10-year proof of satisfactory service. They cure it perfectly, for maximum toughness and service life in all plating and cleaning cycles.

These specialists know that vinyl plastisol Coating 218X will never let them or their customers down. They know that *using the best quality at the outset saves platers most money in the long run.* Send for name of the one nearest you.

Are you using the rack coating that gives you ALL FIVE?

1. *Built-in cure indicator assures maximum performance*
2. *No contamination of plating baths*
3. *Ability to be rebaked for patching*
4. *Nationwide set-up of expert applicators*
5. *Highly qualified technical service.*

UNICHROME

First name in plastisols for all plating purposes ...

METAL & THERMIT CORPORATION

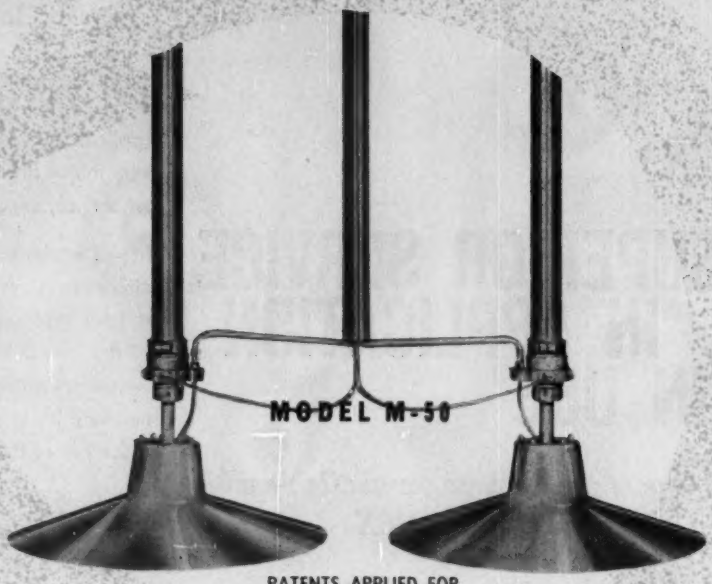
Member, Vinyl Dispersions Division of the SPI

GENERAL OFFICES: RAHWAY, NEW JERSEY

Pittsburgh • Atlanta • Detroit • E. Chicago • Los Angeles

In Canada: Metal & Thermit—United Chromium of Canada, Limited, Rexdale, Ont.

an "IONIC exclusive!



PATENTS APPLIED FOR

"multi-color"

Centrifugal Type electrostatic spray systems....

Now . . . various smooth multi-color finishes can be produced without special coating materials with the amazing **Model M-50 Ionic Electrostatic Spray System** which utilizes an array of airless variable speed centrifugal atomizers for blending of solid single color materials to produce multi-color effects. The variable control characteristics of the system facilitate adaptability for applying unusual finishes and color combinations limited only to the imagination and ingenuity of the operator.

Unique finishes and colors stimulate sales, why not investigate the merits of an **Ionic Electrostatic Spray System** today.

"All systems are sold outright!"

ELECTROSTATIC IONIC CORPORATION ®

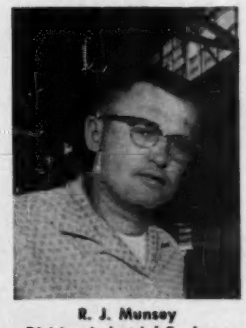
IONIC ELECTROSTATIC CORPORATION

111 MONROE ST. GARFIELD, N. J.

Phone: PRescott 3-1300

"THIS STEVENS BARREL PLATING MACHINE IS SAVING EATON THOUSANDS OF DOLLARS...

...and it's completely automatic!" says R. J. Munsey



R. J. Munsey
Division Industrial Engineer
Reliance Division
Eaton Mfg. Co.
Massillon, Ohio

A Stevens Automatic Barrel Plating Machine, with *one* operator is cadmium plating 1,750 pounds of lockwashers, Springtites, and Keps an hour for Eaton. It has also . . .

- INCREASED PRODUCTION 270%
- REDUCED REJECTS TO LESS THAN 1%
- REDUCED REQUIRED FLOOR SPACE BY 400 SQ. FT.

These savings, both in supplies and labor, mean volume production for Eaton Manufacturing Co. They've discovered, as have an increasing number of progressive companies, that Stevens equipment assures maximum production and superior quality.

Lower costs, consistent quality and assured production are only a *few* of the reasons why Stevens Automatic Barrel Plating Machines are the leaders in their field. For more details, contact your local Stevens Sales Representative today! Find out why more and more metal finishers are looking to Stevens for production savings.

Remember—When you go Automatic...go Stevens!

frederic b. **STEVENS,** inc.

DETROIT 16, MICH

BUFFALO CHICAGO DETROIT CLEVELAND
DAYTON NEW HAVEN SPRINGFIELD (OHIO)

This is the
GERMANIUM
RECTIFIER
that will...

REDUCE YOUR LOST POWER COSTS 45.5%

Proven in world-wide
use to be the most
efficient rectifier
available for
plating applications

Of all semiconductor types...

the Germanium Rectifier features

the lowest voltage loss!

This factor alone can mean real year 'round power savings in your plating operation! For Example: Operating ten hours a day, six days a week, 10,000 ampere germanium power supply will save 912 KWH per week over a silicon unit of the same rating...an annual savings in power dollars amounting to $948.48! These figures are based on an estimated national average cost of $.02 per KWH. If you pay more...you'll save more!

THIS 500 AMPERE hermetically sealed rectifier junction incorporates the largest single crystal junction ever developed. This assures low current density in the crystal despite the extremely high current rating. Result: Added capacity in cases of over temperature and overload.

THE CAST ALUMINUM airfoil housing removes heat at optimum rate. It prevents failure from overheating—a major cause of breakdown. Exclusive construction design makes this rectifier highly resistant to corrosive atmospheres.

THE GE.GA EFFICIENCY attained by this junction is the highest ever, resulting in marked power savings over other types, according to actual records of typical plating supply manufacturers.

FOUR YEARS OF THOROUGH TESTING and use in leading electrochemical plants throughout the world prove its exceptional reliability.

TO SUM UP: In terms of efficiency, size and initial cost--this germanium rectifier junction is absolutely the best for any plating application, from 1,000 to 200,000 amperes!

WHEN YOU BUY A POWER SUPPLY—BE SURE IT CONTAINS THIS RECTIFIER JUNCTION.

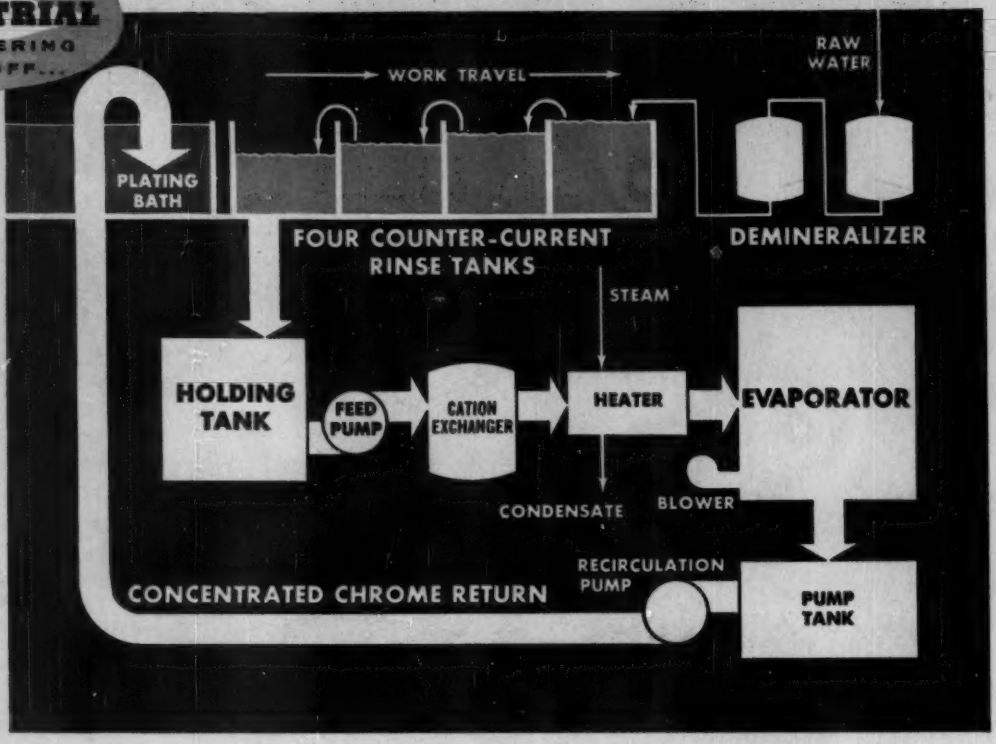
Produced for Leading Equipment Manufacturers by

International Rectifier Corp.

INTERNATIONAL RECTIFIER CORPORATION • EXECUTIVE OFFICES: EL SEGUNDO, CALIFORNIA • PHONE: ORegon 8-6281 • NEW YORK DISTRICT OFFICE: 122 E. 42nd ST. • PHONE: MUrray Hill 2-2930 • CHICAGO DISTRICT OFFICE: 205 W. WACKER DR. • PHONE: FRanklin 2-2666 • NEW ENGLAND DISTRICT OFFICE: 87 MYRTLE STREET, SOMERVILLE, MASS. • PHONE: UNIVERSITY 4-6520 • PENNSYLVANIA DISTRICT OFFICE: SUBURBAN SQUARE BLDG., ARDMORE, PENNA. • PHONE: MIDDLETOWN 2-1744 • MICHIGAN DISTRICT OFFICE: 4700 DOUGLAS AVENUE, RIVERSIDE, MICH. • PHONE: LINCOLN 8-1144

WORLD'S LARGEST SUPPLIER OF INDUSTRIAL METALLIC RECTIFIERS • SELENIUM • GERMANIUM • SILICON

HOW **INDUSTRIAL** ENGINEERING PAYS OFF...



EXAMPLE:

Recovering Chromic Acid at Less Cost than Destroying it

The Chromic Acid Recovery System diagrammed above was engineered by INDUSTRIAL for a large automotive plant. It was developed after a *thorough analysis* of the entire plating operation indicated that desired efficiency would be reached by reducing the rinse water flow rate. When this was done, rinsing was still efficient and complete, with less than 4 ppm acid concentration in the final tank . . . but the higher concentration in the first tank made it possible to use a fast, conventional evaporator to recover Chromic Acid. No pre-concentration was necessary (the small cation exchanger only removed metal contaminants).

After making a careful analysis of operating costs, including labor, power and amortization, as compared with a destruction system of equal capacity, The INDUSTRIAL Recovery System showed a net *GAIN* of $26.65 per day, against destruction *COSTS* of $54.06 per day!

Here, then, is another good example of how INDUSTRIAL engineering pays off by increasing plating efficiency and economy.

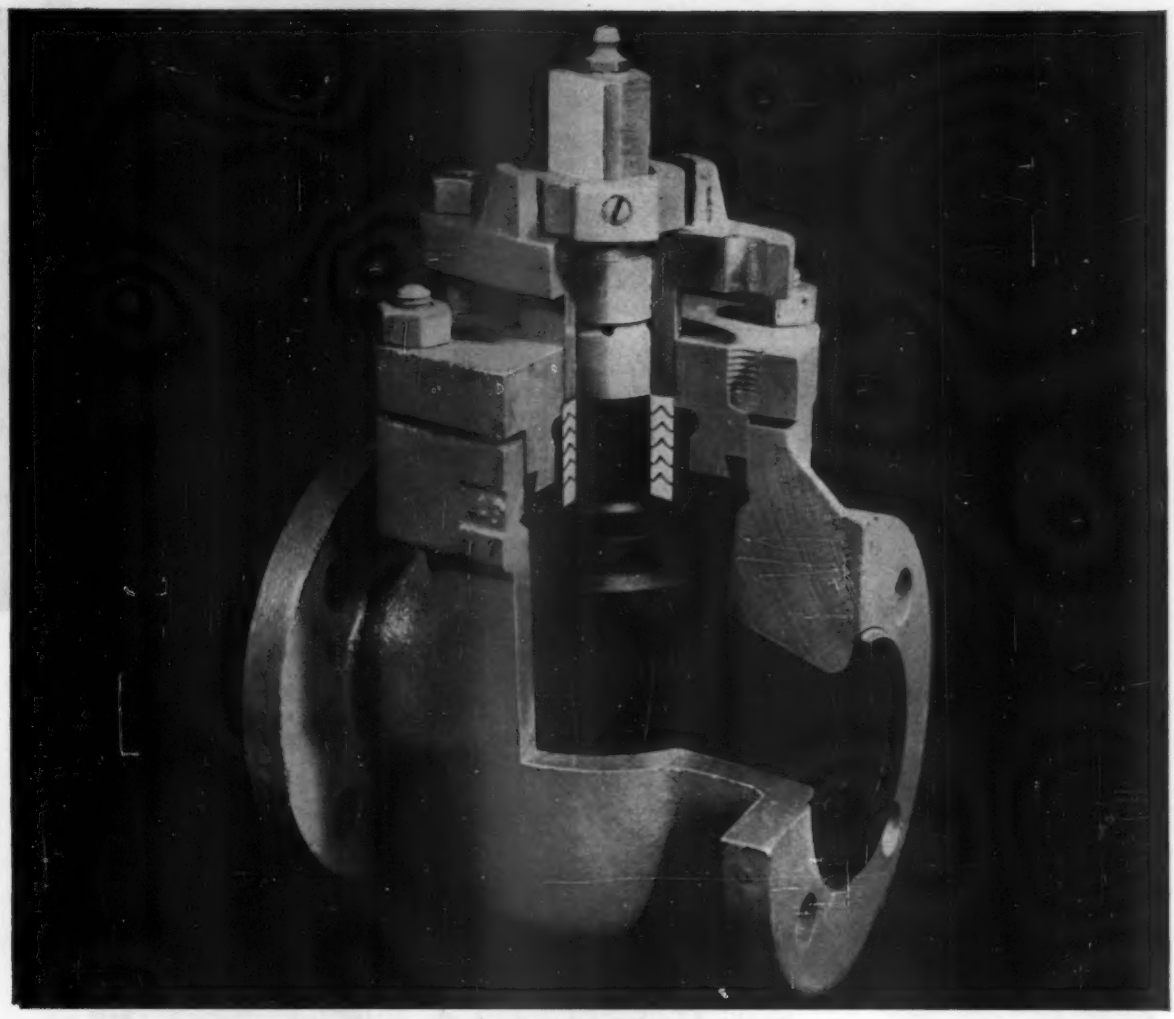
INDUSTRIAL

INDUSTRIAL FILTER & PUMP MFG. COMPANY
5906 Ogden Avenue, Chicago 50, Illinois

Call or write INDUSTRIAL to find out how an engineered system like this can solve your specific plating waste and recovery problems.

F-358

PRESSURE FILTERS ◆ ION & HEAT EXCHANGERS ◆ WASTE-TREATING EQUIPMENT



You can see why Saran Lined Pipe costs so little per year of service

Saran anchored within a steel casing safely conveys corrosive liquids for years of trouble-free service

There's something special about this valve. It's saran lined and has a Teflon V-ring packing for easier opening and closing and more perfect sealing with less pressure. And yet, the fact that valves like this are stock items is another example of why saran lined piping systems are more economical to install.

Immediate availability of Saran Lined Pipe, valves, pumps and fittings means there's no waiting. And Saran Lined Pipe can be cut and threaded right on the job with conventional tools. This lower fabrication cost, combined with the long life of corrosion-resistant saran, means that complete saran lined piping systems cost less in the long run.

Saran Lined Pipe with the new gray liner gives trouble-free service under operating pressures from full vacuum up to 300 psi and temperatures from -20° F. up to 200° F.

Send the coupon today to learn how you can save by installing a complete corrosion-free piping system with Saran Lined Pipe, valves, pumps and fittings. And be sure to ask about Saraloy® 898 tank linings. THE DOW CHEMICAL COMPANY, Midland, Michigan.

SARAN LINED PIPE COMPANY
DEPT. 2003D-2
2415 BURDETTE AVENUE
FERNDALE 20, MICHIGAN

Please send me information on: ☐ Saran Lined Pipe, fittings and valves ☐ Saran lined centrifugal pumps ☐ Saraloy 898 chemical-resistant sheeting

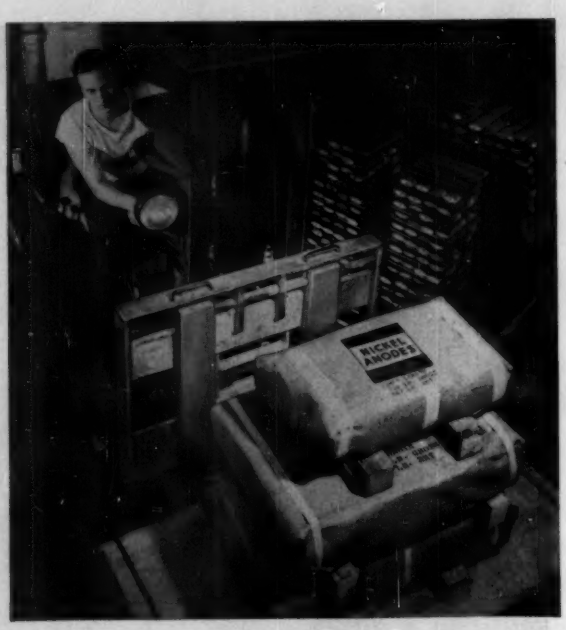
Name_____ Title_____ Company_____

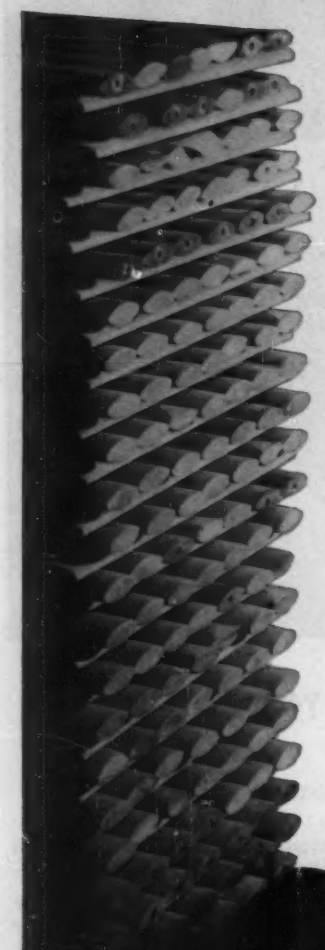
Address_____ City_____ State_____

YOU CAN DEPEND ON DOW

Prompt Delivery of any Quantity

HARSHAW
Nickel Anodes
99+%





HARSHAW XXX CAST CARBON NICKEL ANODES are oval 1½" x 3" in cross section and are available in any length desired. Weight is approximately 1.1 lbs. per linear inch. They are normally used in dull, semi bright and bright nickel plating baths where the pH is 4.5 or lower.

HARSHAW ROLLED OVAL CARBONIZED NICKEL ANODES are 1¼" x 3" in cross section and are available in any length desired. Weight is approximately 1 lb. per linear inch. They are generally used in dull, semi bright and bright nickel plating baths where the pH is 4.5 or lower.

HARSHAW ROLLED OVAL DEPOLARIZED NICKEL ANODES have the same cross section and weight as the rolled oval carbonized nickel anode and are also available in any length desired. These anodes are generally used in nickel plating baths where the pH is 4.0 or higher; they are extremely suitable for such use, as they will corrode well over a wide range of operating conditions.

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Harshaw anodes are wrapped in a fibre reinforced laminated (without asphalt) paper. They are protected from tramp oils, dirt and grease and remain clean until used. The possibility of such contaminents being introduced into the plating solution from anodes is thus kept to a minimum.

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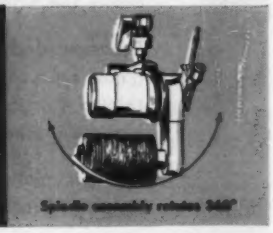

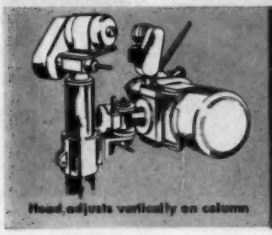

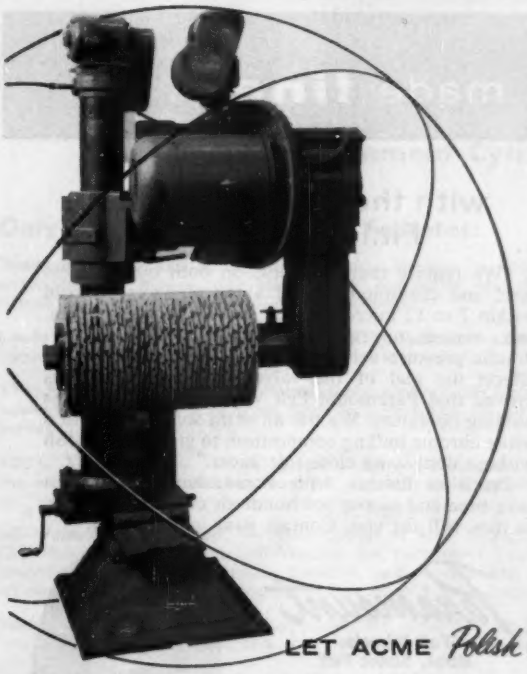

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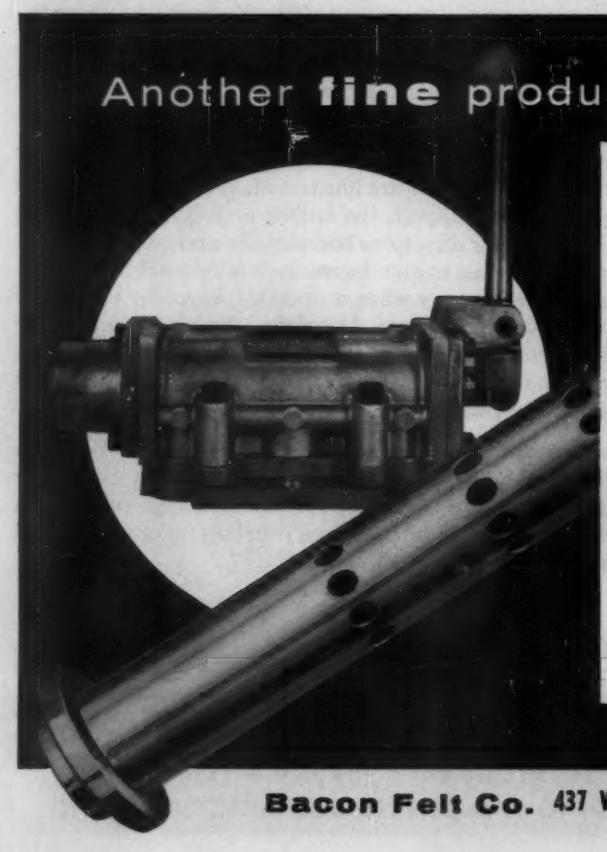

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"A"	NO	NO	NO	NO	YES	NO
"B"	YES	NO	NO	YES	NO	NO
"C"	NO	NO	YES	NO	NO	NO

The above is based on actual service tests, plus technical data made public by the manufacturers of all cylinders represented in the chart. Brand names of cylinders A, B, and C available on request.

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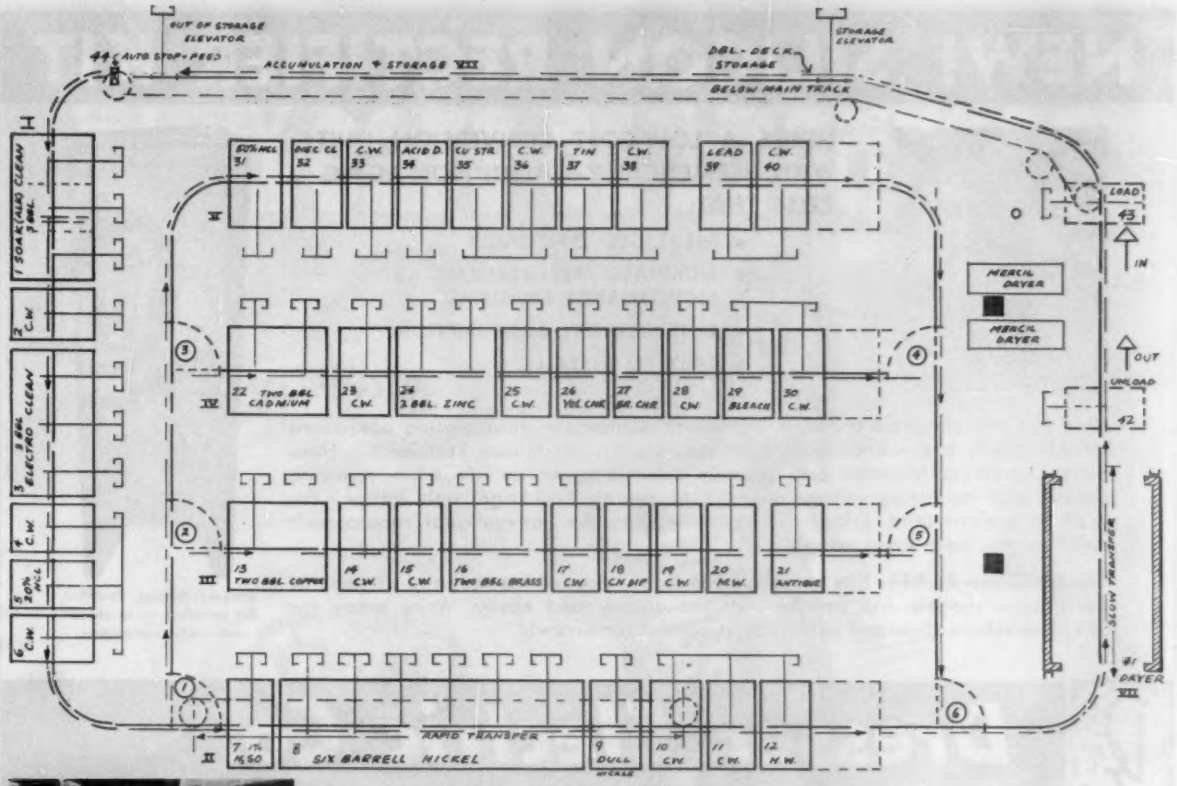

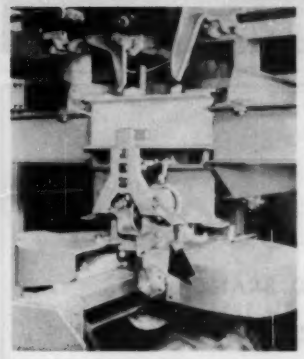

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3. **Copper** — 1-6, 13-15, 20, 41-44
4. **Brass** — 1-6, 16-20, 41-44
5. **Antique** — 1-6, 13-15, 21, 41-44
6. **Cadmium** — 1-6, 22, 23, 41-44
7. **Zinc** — 1-6, 24, 25, 41-44
8. **Cadmium-Chromate** — 1-6, 22, 23, 27-30, 41-44
9. **Zinc-Chromate** — 1-6, 24-26, 28, 30, 41-44
10. **Tin** — 1-6, 37, 38, 41-44
11. **Lead** — 1-6, 39, 40-44
12. **Cu Strike on Die Cast** — 32-36, 41-44

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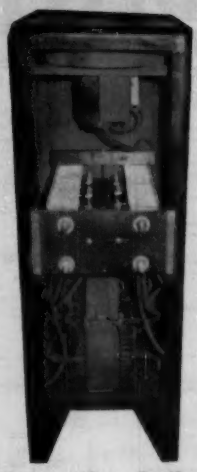

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DECEMBER 12-13
Annual Educational Session and Christmas Party, Hotel Robert Treat, Newark, N. J.

BUFFALO BRANCH
DECEMBER 20
Annual Christmas Party, Niagara Manor, Buffalo, N. Y.

GRAND RAPIDS BRANCH
JANUARY 17, 1959
Annual Educational Session and Banquet, Pantlind Hotel, Grand Rapids, Mich.

CHICAGO BRANCH
JANUARY 31, 1959
Annual Meeting and Banquet, Conrad Hilton Hotel, Chicago, Ill.

CLEVELAND BRANCH
JANUARY 31, 1959
Annual Educational Session and Dinner-Dance, Cleveland, Ohio.

NEW YORK BRANCH
FEBRUARY 7, 1959
Annual Educational Session and Banquet, Hotel Statler Hilton, New York, N. Y.

DIXIE REGIONAL GROUP
FEBRUARY 13-14, 1959
Educational Session and Banquet, Southeastern Host Branch, Dinkler Plaza Hotel, Atlanta, Ga.

ROCKFORD BRANCH
MARCH 7, 1959
Annual Educational Session and Banquet, Faust Hotel, Rockford, Ill.

FIFTH INDUSTRIAL FINISHING EXPOSITION
JUNE 15-19, 1959
Golden Jubilee Convention and International Exposition, Including Fifth International Conference on Electrodeposition and Metal Finishing; Convention Headquarters — Hotels Statler Hilton and Sheraton-Cadillac; Exposition — Artillery Armory, Detroit, Mich.

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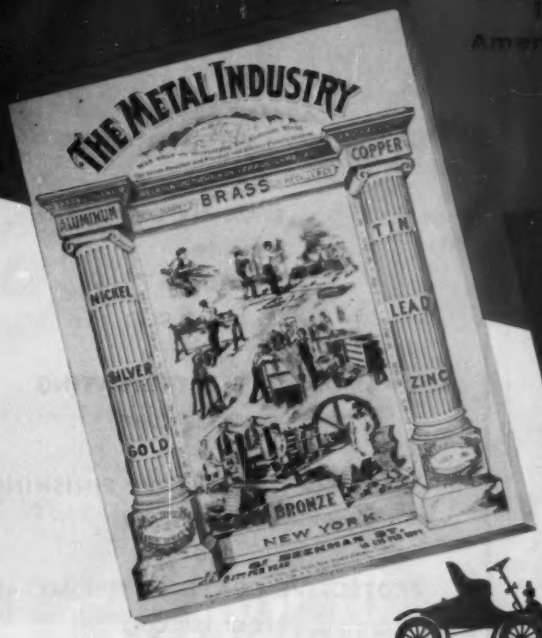
1903-1959

1959—50th Anniversary of the American Electroplaters' Society—and Metal Finishing's 56th progressive year of service to the industry.



1903—the founding of the Ford Motor Company—*The Metal Industry* Magazine (now *"Metal Finishing"*) began its service to the electroplating and allied industries of America. In January 1959, *Metal Finishing* starts its 56th year with an outstanding record of growth in circulation, breadth of editorial coverage and quality of readership.

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Metal Finishing, recently combined with its companion publication, *Organic Finishing*, now offers a concentrated, unduplicated audience that incorporates the heart of each magazine's circulation.

Our paid circulation of $5.00 per year ($10.00 foreign) is now at an all time high and covers Polishing and Buffing, Barrel Finishing, Cleaning, Plating, Anodizing, Rustproofing, Lacquering, Enameling and Vacuum Metalizing departments.

The still-growing book . . . this year . . . goes to more individual companies in the plating and industrial coating fields; is read by more professional executives, chemists, metallurgists, project managers . . . more production executives, works, plant and production managers . . . more government procurement officers.

GROWTH IN QUALITY

Editorial staff now combines the outstanding authorities in *both* metal finishing and organic finishing areas. This is the most comprehensive, best-integrated staff *Metal Finishing* has ever offered — with the most extensive news-gathering machinery in its field.

Reader-appreciation of *Metal Finishing's* expanded service is at an all-time high. Hundreds of unsolicited letters and comments prove the value of how-to-do-it information, technical papers, stimulating articles on world-wide finishing developments, market trends, production figures, personnel changes. Readers paid a total of $36,063 for *Metal Finishing* during the year ending July 31, 1958.

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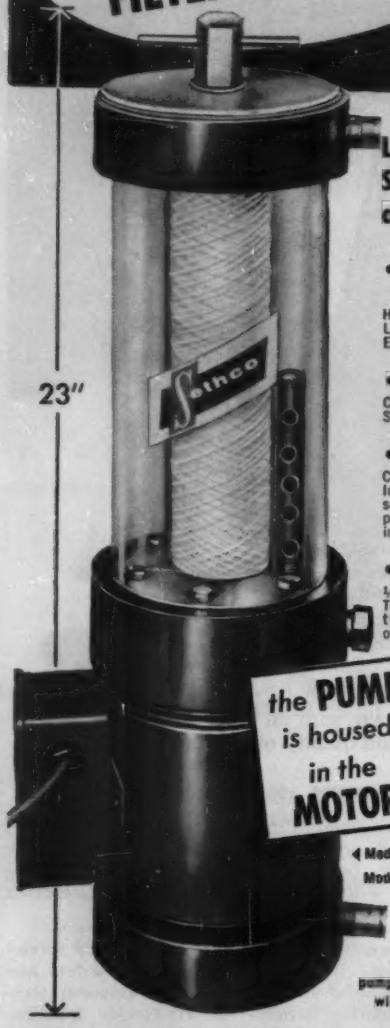

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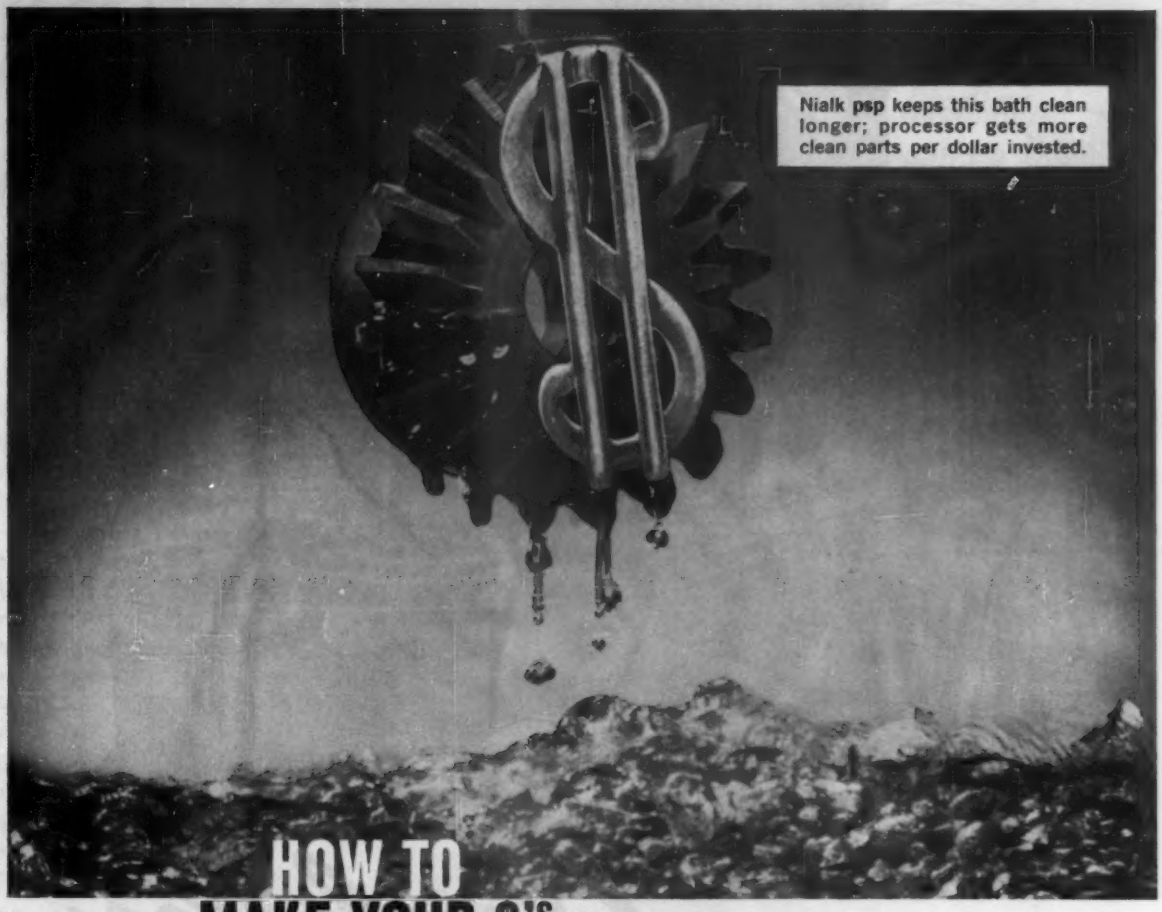

HOW TO MAKE YOUR $'S DEGREASE MORE PARTS

You make no profit on the time you spend cleaning out a degreaser.

You cut another slice off the top of profits whenever you have to add fresh stabilizer to your trichlorethylene bath.

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psp is the simple answer

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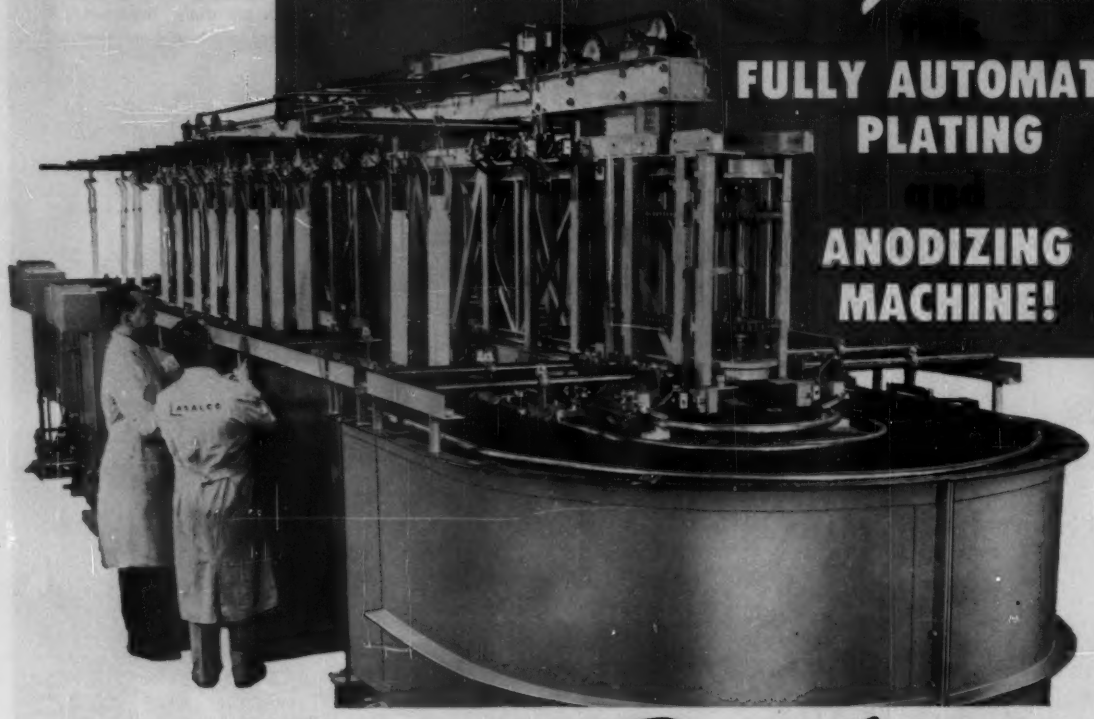

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FEATURES

Editorial — Year End Thoughts 43

Polishing and Buffing of Aluminum 44
By Lamont J. Benson

Effects of Impurities in a Bright Nickel Bath on the Covering Power of a Chromium Bath 46
By Robert H. Rousselot and Georges E. Rousselot

Automation Painting in Russian Machine Tool Manufacturing 51
By A. J. Steiger

Pumps and Their Uses in Spray Painting 54
By J. Arthur Weed

Finishing Zinc Base Die Castings 56
By Lester Spencer

Stripping Metallic Coatings 60
By J. B. Mohler

Iron Analysis in Chromium Solutions 64
By A. Salka

Technical Control Data 65

Science for Electroplaters — Part XLII 66
By L. Serota

DEPARTMENTS

Shop Problems	70	Manufacturers' Literature	90
Patents	72	Associations and Societies	92
Abstracts	74	New Books	101
Recent Developments	76	News from California	102
Business Items	84	Obituary	103

Annual Index 105

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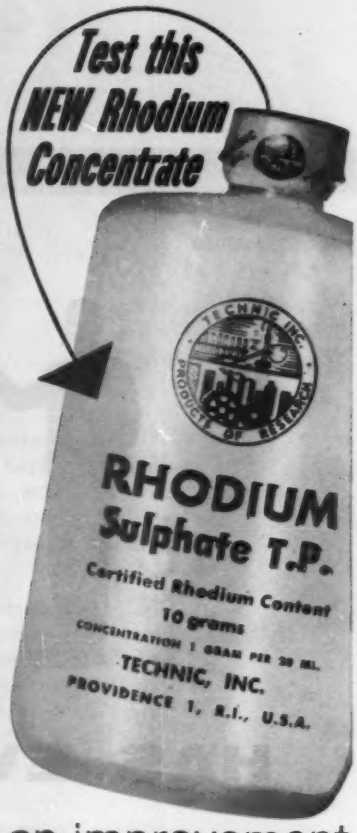

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YEAR END THOUGHTS

As each year draws to a close, the editor's thoughts always seem to be shunted away from the problems of the moment, and his mind begins to thumb through the pages of the past — sometimes the recent past, but more often the far distant past when he first decided that metal finishing offered a promising future for a youngster who liked chemistry and was handy with tools. It is hard to believe that thirty years have gone by so swiftly.

Those were the days when most of the giants of our industry were still around and active, the "old timers" we listened to in silent awe and venerated because they were not only transforming an interesting art into an established science but, at the same time, were teaching the tyros so that we could advance in their footsteps. To serve them they had a silver solution which hadn't been improved in seventy-five years, an acid copper sulfate bath which was still older and unchanged, and a cold double salt nickel formulation which was controlled by taste because test methods hadn't yet been developed.

Their plating current came from batteries and later, from primitive dynamos, their meters were modified magnetic compasses, rheostats were coils of iron wire and, much of the time, their plating salts were of indefinite composition and purity, if not home-made. But, thirty years ago, they had already laid the foundations for our present practice. Because of them we had dependable generators, meters, salts, and methods of control so that, during the past three decades, our progress has been able to take place in leaps and bounds, comparatively.

They left us a heritage we are bound to advance as best we can, to teach others as they taught us, so that those who follow us will have their task made less burdensome and more rewarding, as was ours in our time. And, as a parting thought, just consider how gratifying and assuring it is to labor in a field where a man becomes more valuable and respected for his knowledge and experience as he grows older, rather than less so.

Nathaniel Hall

Metal Finishing

Wishes You A Very Merry Christmas and A Happy and Prosperous New Year

Polishing and Buffing of Aluminum

By Lamont J. Benson, *Kaiser Aluminum & Chemical Sales, Inc., Chicago, Ill.*

THE surface finish of aluminum as-fabricated, i.e., as-cast, as-rolled, and as-extruded, often needs improvement to produce an acceptable end product. Also, forming and/or assembly frequently leaves abrasions, scratches or roughened and discolored weld areas that must be removed. For these reasons, as well as that of producing a uniform distinctive appearance, various types of mechanical finishes are applied to aluminum. These finishes may be accomplished in many ways such as by blasting, burnishing, roll embossing, wire wheel finishing, polishing and buffing. For the present it is our plan to confine our attention to the last two, especially in reference to wheel finishing.

Abrasives

Polishing is either the first or an intermediate step in a complete finishing sequence. Utilization of abrasive of proper size and uniformity is necessary that proper finishing be accomplished. If course, oversize particles are present in the abrasive mixtures, scratching will occur. With an excess of small particles cutting action naturally is decreased. The abrasives commonly used for polishing of aluminum are:

(1)—Silicon Carbide (SiC)

This is the hardest of the common abrasives. However, because of its brittleness, it shatters under buffing pressures, producing new cutting edges which partially offsets this disadvantage.

(2)—Aluminum Oxide—(Al_2O_3)

Abrasives of this type are extremely hard and tough. High shock and impact resistance are characteristic.

Buffing usually follows polishing and is designed to improve the appearance of the metal surface, producing a luster by flowing the metal with little or no metal removal as contrasted to polishing. The buffing abrasives are:

(1)—Tripoli

This natural material, an amorphous silica, containing varying amounts of iron oxide as evidenced by a color range of yellow to dark red, is the outstanding aluminum buffing abrasive. Since it is very absorptive of water, grease or oils, it lends itself to incorporation in buffing compound stick and liquid formulations. Tripoli also has the characteristic of breaking down its particle size under buffing pressures. For this reason buffing as well as a degree of color buffing often is accomplished on the same wheel.

(2)—Amorphous White Silica

This abrasive usually is of a finer size than tripoli and, therefore, its use follows tripoli buffing to produce more mirror-like finishes.

Types of Wheels

For the initial stages of finishing, i.e., grinding and polishing, built up solid or semi-solid wheels are used, faced with the necessary abrasive. These wheels usually are made of muslin built up to desired width and then faced with the desired abrasive. Formerly hide glue was used exclusively for attaching the abrasives to polishing wheels. In recent years silicate cements have increased in acceptance for preparing this type of polishing wheel.

In the final stages of buffing and color buffing where little or no metal is removed, ventilated type muslin buff sections are used to make up desired width wheels. With these the buffing abrasive is applied by stick or spray. The incorporation of built-up wheels of sisal (bias, finger, or rope type) or a sisal and muslin combination, the latter permitting of greater adhesion of buffing compound, will permit of appreciable cut with tripoli compounds.

Polishing and Buffing Sequence

As would be expected, the initial surface condition and the desired finish will determine the number and sequence of polishing and buffing operations employed. If the item to be finished were a casting or of a heavy sheet that was deeply scratched or gouged, a total of some 5 finishing operations probably would be used, i.e.:

(1)—Grinding

Silicon carbide abrasive of 20-60 grit size on faced wheel, operated at a maximum peripheral wheel speed of 4,000 ft./min., lubricated with suitable material to prevent wheel pick-up.

(2)—Roughing

Emery or fused Al_2O_3 abrasive 60-120 grit size on faced wheel. A peripheral wheel speed of 5,000 to 6,000 ft./min. with proper lubrication of facing is recommended for this operation. A variation of this step, as well as the one immediately following, is the use of a backstand idler with abrasive belt suitable for flat surface finishing. Lubrication needed.

(3)—Greasing

A wheel similar to that used in Steps 1 and 2, faced with 180-220 abrasive. Wheel speed approximately the same as for roughing, lubrication of wheel as with other set-up wheels.

(4)—Buffing

Wheels usually are open air-cooled type made of stitched, bias-cut muslin. Abrasive, usually tripoli, is applied to buff by means of stick or spray. Peripheral wheel speeds up to 7,000 ft./min. are customary. This

operation accomplishes actual metal flow that fills in the cuts produced by polishing.

(5)—Color Buffing

Same type of wheel and speeds as with buffing. Abrasive used may be Vienna lime or white silica compound. Many times the final wheel is not compounded, it being used as a wipe, the only abrasive being residual tripoli on the work from the buffing operation.

Additional Considerations

The discussion up to this point has been confined to the bare mechanics of mechanical polishing and buffing with no consideration other than that of producing a mirror-like buffed finish. This usually is sufficient if the ultimate is the polished and buffed finish presently furnished on aluminum cooking utensils and comparable items or, if the buffed surface is to serve as a base for the application of electrodeposits of copper, nickel or chromium. However, if the aluminum item is mechanically polished and buffed preliminary to the application of an anodized finish to serve as a protection to the mechanical finish, then additional thought must be given to other factors such as:

(1) Has the proper alloy been selected?
(2) More careful selection of abrasives and their usage.
(3) Proper removal of polishing and buffing residues prior to anodizing either:
   (a) By surface cleaning with non-etch or mildly etchant alkaline solutions.
   (b) By the use of concentrated acid brighteners to remove surface and sub-surface entrapped oxide and/or compound residue.
(4) Assurance that proper anodizing techniques are followed.

Now let us consider each of these four points in order:

ALLOY SELECTION:

If the proposed application calls for a polished or buffed finish only, then the common sheet alloys 1100, 3003 or 5005 and the extrusion alloy 6063 should prove satisfactory. Proper temper and grain size must be considered in order that the desired formability allows the item to be produced and that a minimum of orange peel results. This latter condition, if excessive, adds to the polishing and buffing problems. On the other hand, if a high degree of specularity is desired after anodizing, then domestic sheet alloys such as high purity clad reflector sheet, #5357 & #5457, all three being specialty sheet products, or 5357 and 6463 extrusions should be specified. The same concern regarding resultant orange peel upon forming must be taken with these alloys as with the common alloys.

ABRASIVE SELECTION AND USAGE:

If silicon carbide is used in polishing, a residue frequently is left on and in the surface of the aluminum which, upon subsequent anodizing, will result in a darkened, mottled appearance. Therefore, it is advisable under such circumstances to utilize aluminum oxide abrasives exclusively for the polishing operations.

With the buffing operation, however, more difficulty is encountered since residues of the almost universally used buffing compounds, tripoli and amorphous white silica, can be expected to have similar discoloration effects. Added to the possible discoloration from the silicas is that of iron impurities present in the tripoli. This then, since no other suitable substitute abrasive is available, can only be at best minimized by care in buffing to prevent burning-in or imbedding of compound. Actually, it is only accomplished thoroughly by the methods next to be described.

REMOVAL OF SURFACE ADHERING AND IMBEDDED ABRASIVES:

One of the accepted architectural finishes applied to 6063 extrusions is that of anodizing preceded by a mechanical polishing with 180-220 grit. Incorporated in this finishing sequence is the use of a short etching treatment in an alkaline etchant. This etching serves not only to produce a semi-lustrous satin finish but also to remove abrasive residues. However, where a high degree of luster is desired, as with reflector sheet items or with automotive trim items fabricated of 5357 and 5457 sheet or 5357 and 6463 extrusions, a buffed finish is necessary. With this type of finish, alkaline etching cannot be used since "dulling" will result. Therefore, to prevent this reduction in specularity, it is common practice to use either chemical or electrochemical brighteners. This type of processing not only serves to remove polishing and buffing residues but also produces an actual leveling and simultaneous brightening effect.

PROPER ANODIZING TECHNIQUE:

We now have arrived at the point of considering the final processing, that of applying a protective artificial oxide coating to the mechanically finished aluminum. This oxide coating, if applied properly, should serve two purposes:

(1) To protect the cleaned and brightened metal from abrasion in service.
(2) Also to act as a deterrent against the action of common corrosive media.

In order that the final coating be of uniform quality, it is suggested that the following points be given attention:

(1) Anodize under controlled conditions of temperature, time, current density, and acid concentration as determined to produce the desired results.
(2) Maintain racks so that consistent flow of current can be expected to items being anodized.
(3) Adhere to thorough rinsing practices following bright dip and anodizing, otherwise mottling or staining may result.
(4) Seal properly, definitely above 200°F. and preferably near the boiling temperature in deionized water. This will avoid the production of a "sticky" absorbent coating. On the other hand, care must be taken to prevent over-sealing which is evidenced by a chalky deposit on the work.

(*Continued on page* 50)

Effects of Impurities in a Bright Nickel Bath on the Covering Power of a Chromium Bath*

By Robert H. Rousselot, *Electrolysis Laboratory, French National Center for Scientific Research, Paris, France*
and Georges E. Rousselot

Introduction

WHEN it is noticed by means of a few simple clues (such as the absence of chromium deposit around holes or a reduction of the covered area in recesses) that the covering power (CP) of the chromium bath in a conventional copper-nickel-chromium line has decreased, the immediate assumption is that the chromium bath itself is at fault. Yet, if the covering power is checked by means of the bent cathode method in a Hull cell,[1] it frequently turns out that the CP of the chromium bath has not changed. The reason for this apparent anomaly is that one of the basic characteristics of this factor is overlooked: the covering power is a function not only of the independent variables of the chromium bath, but also of the basis metal and its preparation which, in the present instance, is the underlying nickel plate.

In the course of operation, two kinds of impurities build up in a bright nickel bath, metallic and organic. The sources of the metallic impurities are as follows:

a. The dissolution in the bath of the parts plated (usually steel, zinc or brass) and/or of the deposit previously received (copper).

b. The chemicals used to make up and replenish the bath, which often contain a percentage of metallic impurities that is not negligible.

c. The anodes.

d. The equipment in contact with the solution (pumps, filters, heat exchangers, etc.).

e. The drag-in of traces of solutions preceeding the nickel bath by the racks or the parts themselves.

The sources of organic impurities are:

a. Primarily, the decomposition products of the organic compounds used as addition agents (brighteners, levelers and wetting agents).

b. Secondarily, the linings of tanks, pumps, and filters, the rack coatings, etc., that come into contact with the nickel bath and certain components of which (plastifiers, dyes, vulcanization accelerators, anti-oxidizing agents, etc.) may be extracted.[2]

c. Accidentally, dust and dirt on work, and buffing compounds unremoved in the preceeding cleaners.

Behavior of Impurities

It is well known that the metallic impurities in a bath act primarily in the low current density areas. The foreign metal ions in low concentration are discharged in the low current density areas in conformity with Nernst's law; that is why a so-called "selective" electrolysis is performed with a very low current density and using corrugated cathodes, or flat cathodes set oblique to the plane of the anodes, in order to deposit the metallic impurities of a bath (see Appendix 1).

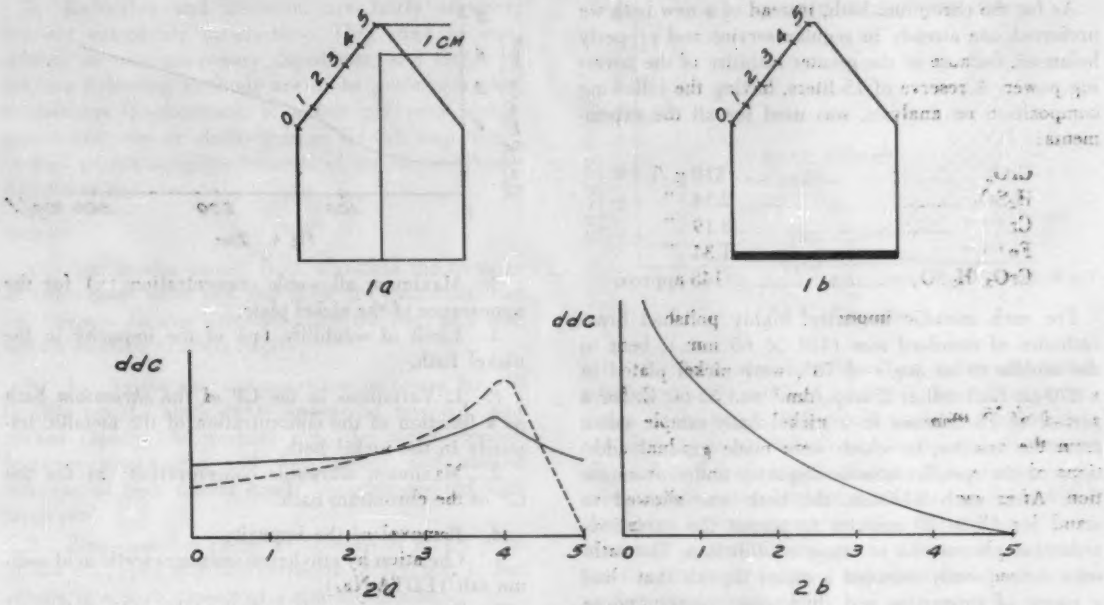
The organic impurities also act in the low current density areas through a physico-chemical process that is not very well understood, but which probably involves the structure of these ions (derived from large molecules), their polarity, the activation energy, etc.

The metallic and organic impurities acting at low current densities produce a change in the structure of the deposit formed in these areas, which is evidenced by a change in the properties of the deposit (composition, crystal structure, brightness, ductility, surface activity, etc.) in comparison with the metal deposited at higher current densities.

Effects on Chromium Covering Power

As we have said, the covering power of a chromium bath, i.e. the minimum current density at which the chromium deposit begins to form, is extremely sensitive to the nature and properties of the metal surface on which chromium is deposited. Since the impurities in the nickel bath alter the nickel deposit in the areas of low current density, where the lower limit of the chromium deposit is located, it is easy to understand that the impurities of a nickel bath may have a considerable influence on the covering power of the subsequent chromium deposit. This fact is nicely illustrated by two very simple tests that can be made if there is reason to believe that it is the nickel bath which is responsible for the poor covering power of the chro-

*A paper presented at the Annual Conference of the French Hard Chromium Platers' Association, Paris, May 24, 1957.



Figs. 1 & 2. Anode-cathode arrangement in the Hull cell for the control tests, and corresponding current distribution.

mium bath. Let us therefore consider a contaminated nickel bath and a well balanced chromium bath.

CONTROL TESTS:

In the first test, a bent cathode is nickel plated in a Hull cell by setting a flat, thin anode along the bisecting plane up to 1 cm. from the angle (Fig. 1a) in order to obtain a fairly uniform secondary distribution of the current (Fig. 2a) on the cathode (see Appendix 2). After water rinsing, the nickel plated cathode is chromium plated in a Hull cell, using the customary arrangement (Fig. 1b). Since the nickel plate will have nearly uniform properties along the entire cathode, the length covered by the chromium deposit will be optimum for the conditions under consideration.

In the second test, a bent cathode is nickel plated in the cell, using the normal arrangement (Fig. 1b). In this manner, the cathode will receive a wide range of current densities (from practically zero at the apex to very high values at both ends), as is shown in Fig. 2b. The properties of the deposit thus obtained (including its thickness) vary continuously and correspond exactly to the nickel plate that the various points of the pieces will receive at the various local current densities that prevail in the nickel tank. If we now chromium plate this cathode as in the previous test, we find that, if the nickel bath is contaminated as we have assumed, the length covered by the chromium deposit, all other things being equal, is decidedly shorter than in the first test. The reason for this is the alteration, by the impurities, of the nickel deposit in the low current density areas.

We thought it might be interesting to determine qualitatively and quantitatively the effects of impurities in the nickel bath on the covering power of the chromium bath by using the bent cathode method. Unfortunately, we have been compelled to limit ourselves to metallic impurities, owing to the impossibility of making a systematic survey of the organic impurities. As a matter of fact, although the source of these impurities is known, their nature in solution is not always known. A possible approach was to extract these impurities from a contaminated bath and introduce them by aliquots into a clean bath; it would have been easy to adsorb these impurities in activated carbon, but complete desorption appeared impracticable. Nevertheless, even if this problem had been solved, such an investigation would have had an indicative value only, since the sources of organic contamination vary greatly from one bath to another.

Experimental Procedure

We examined the effects of the following metallic impurities successively: copper, zinc, iron, chromium, lead, tin, cadmium, and molybdenum. Usually, these were introduced into samples of a stock nickel bath as dilute sulfate or chloride solutions of the metal in question.

In order to confer greater practical application upon this study, we selected a widely used proprietary bright nickel bath, prepared with analytically pure chemicals, and having the following basic composition:

$NiCl_2 \cdot 6H_2O$	200 g./l.
$NiSO_4 \cdot 6H_2O$	90 "
H_3BO_3	40 "
Brightener #3	8 "
Brightener #1	1.25 cc./l.
Wetting agent	0.6 g./l.
pH (electrometric)	3.5

A stock of 15 liters of this solution was prepared for use in all the experiments. Brightener #3 acts at high and medium c.d., whereas Brightener #1 acts at low c.d. The wetting agent is a heavy alcohol sulfate which lowers the surface tension of the bath to approximately 25 dynes per cm.

As for the chromium bath, instead of a new bath we preferred one already in regular service and properly balanced, because of the greater stability of the covering power. A reserve of 15 liters, having the following composition on analysis, was used for all the experiments:

CrO_3	310 g./l.
H_2SO_4	2.14 "
Cr^{+++}	3.19 "
Fe^{+++}	1.34 "
CrO_3/H_2SO_4	145 approx.

For each metallic impurity, highly polished brass cathodes of standard size (101 × 65 mm.), bent in the middle to an angle of 78°, were nickel plated in a 270-cc. Hull cell at 2 amp./dm.² and 55-60°C. for a period of 15 minutes in a nickel bath sample taken from the reserve, to which were made gradual additions of the specific metallic impurity under examination. After each addition, the bath was allowed to stand for 15 to 20 minutes to permit the oxidation-reduction phenomena to attain equilibrium. The cathodes consequently received a nickel deposit that had a range of properties and thicknesses corresponding to the plate received in actual practice by the pieces according to the current density obtaining at their various points.

After nickel plating and cold water rinsing, the successive cathodes were immediately chromium plated in a 270-cc. Hull cell at 8 amp./dm.² and 35°C. for a period of 3 minutes, in a sample on the chromium bath taken from the reserve.

The covering power was then measured on each of the cathodes and plotted versus the concentration of the metallic impurity introduced into the nickel bath.

Presentation of Results

The results obtained for each impurity will be presented in a standard form, as indicated below. We thought it advisable not to limit ourselves merely to the variations in covering power, but to add remarks and observations, especially as regards visual quality (herein called appearance) of the nickel deposit and the general methods for eliminating the impurities.

For each impurity we shall therefore give the following data:

a. Source of impurity

1. Appearance of the nickel plate as a function of the concentration of the metallic impurity.

2. Possible action of the impurity on the CP of the *nickel* bath, which may result in no deposit in low c.d. areas.

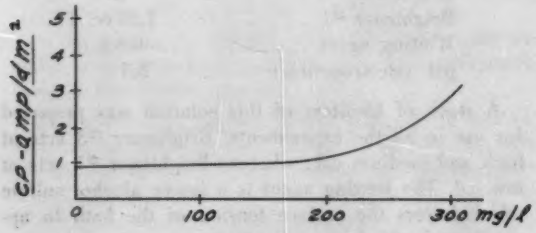


Fig. 3. Copper

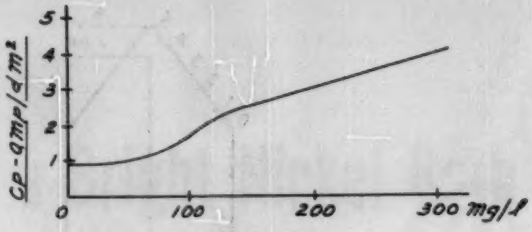


Fig. 4. Zinc

3. Maximum allowable concentration (x) for the appearance of the nickel plate.

4. Limit of solubility (y) of the impurity in the nickel bath.

c. 1. Variations in the CP of the *chromium* bath as a function of the concentration of the metallic impurity in the nickel bath.

2. Maximum allowable concentration (z) for the CP of the chromium bath.

d. Removal of the impurity

1. Chelation by ethylenediamintetraacetic acid sodium salt (EDTA-Na_4).

2. Reduction by sodium hydrosulfite ($Na_2S_2O_4$), or reduction by $Na_2S_2O_4$ and chelation, or reduction and precipitation.

3. Displacement, or electrolysis at low current density.

COPPER:

a. Copper is introduced into nickel baths by the chemicals and by the anodes, as well as by parts made of brass, copper, or copper-plated before nickel plating. For our purpose, Cu was introduced as a copper sulfate ($CuSO_4 \cdot 5H_2O$) solution.

b. 1. When the copper concentration is increased to 300 mg./l., a milky haze appears at low c.d., and then dark stains which spread and form a fairly extensive dark area (up to 0.8 amp./dm.²). At medium c.d., the deposit becomes marbled and cloudy while, at high c.d., it becomes semi-bright and pitted.

2. Cu is thus characterized at low c.d. by a dark area, but does not result in there being no nickel deposit.

3. The maximum allowable concentration (x) for the appearance of the nickel plate is approximately 100 mg./l.

4. The solubility limit was not reached.

c. 1. The curve in Fig. 3 shows that the CP of the chromium bath increases slowly at first up to 150 mg./l., and then far more rapidly.

2. Consequently, the maximum allowable concentration (z) for the covering power may be estimated at 200 mg./l.

d. 1. The chelation of a solution containing 300 mg. of Cu per liter by EDTA-Na_4 brings about a decided improvement. The dark area at low c.d. is reduced and the nickel deposit becomes brighter at medium and, especially, high c.d. The CP of the chromium bath is decidedly improved.

2. Reduction in the presence of the chelating agent causes an even further improvement in the appearance and the CP.

3. Reduction and chelation are fairly effective, but not completely satisfactory. They may be considered as only temporary expedients, and either of the two following methods are to be preferred: electrochemical displacement at a low pH onto nickel-plated cathodes or electrolysis at 0.1-0.2 amp./dm.^{2}, as they permit complete removal of the impurity (see Appendix 2).

ZINC:

a. Zinc results mainly from zinc-base die castings or from brass work and also from the chemicals. For our purpose Zn was introduced into the bath as a zinc sulfate solution ($ZnSO_4 \cdot 7H_2O$).

b. 1. As the zinc concentration increases from 0 to 300 mg./l., black spots appear at low c.d. and spread rapidly. At medium c.d., the nickel deposit becomes semi-bright and then rough and uneven whereas, at high c.d., it finally becomes covered with large pits.

2. Zinc does not cause an absence of nickel plate at low c.d., even at a concentration of 300 mg./l., but results in a dark deposit of a zinc-nickel alloy.

3. The maximum allowable concentration (x) for the appearance of the nickel plate is estimated to be in the vicinity of 75 mg. of Zn per liter.

4. The solubility limit was not reached.

c. 1. The curve in Fig. 4 shows that the CP rises rapidly beyond 75 mg./l.

2. This may then be taken as the maximum allowable concentration (z).

d. 1. Chelation by EDTA-Na_4 of 300 mg. of Zn per liter brings about no change.

2. Reduction by $Na_2S_2O_4$ (0.4 g./l.) in the presence of the chelating agent causes a slight improvement in the appearance by making the plate more even and eliminating the pits. However, the dark spots at low c.d. are not eliminated, and the CP of the chromium bath remains unchanged.

The precipitation of zinc as $Zn(OH)_2$ by raising the pH is problematical, for the pH must be at least equal to or greater than 5.5, at which point a large quantity of nickel is precipitated as $Ni(OH)_2$.

3. Electrolysis at 0.2-0.3 amp./dm.^{2} remains the only effective and efficient method.

IRON:

a. Iron results mainly from the attack of steel pieces (hollow parts, tubes, etc.) that are treated or that fall to the bottom, and secondarily from the chemicals and from the andoes.

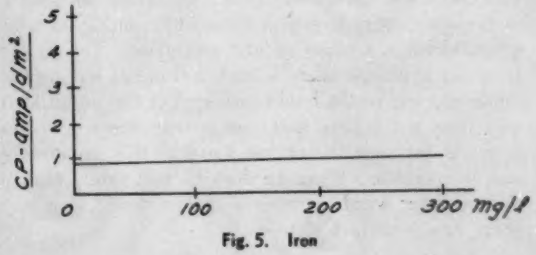


Fig. 5. Iron

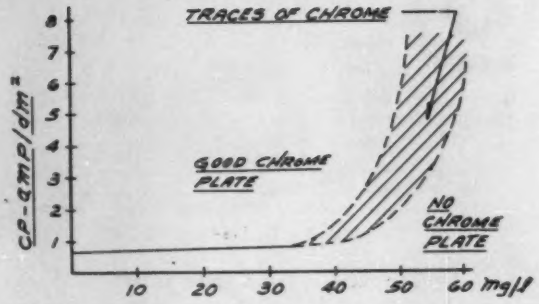


Fig. 6. Chromium

b. 1. Iron was introduced as a ferrous sulfate solution slightly acidified by H_2SO_4 but, through oxidation at the anode, it becomes ferric and precipitates out partially at pH 3.5. Consequently, the pH was readjusted to 3.5 after each addition. Cloudiness of the solution was noted beginning at 100 mg./l., and this cloudiness became greater as the additions were made, resulting in precipitates of $Fe(OH)_3$. In industrial practice, these precipitates are eliminated by filtration as they are formed.

2 & 3. The presence of iron does not greatly alter the appearance of the nickel deposit up to 300 mg./l. added.

4. The limit of solubility depends on the pH and on the possibility of oxidation at the anode.

c. 1. The curve in Fig. 5 shows that the CP is not changed for the quantities of *added* iron at pH 3.5.

2. Same remark as above. If the pH is sufficiently high, there is little or no Fe in solution.

d. Since iron is automatically eliminated by oxidation and precipitation, there is no need to look for another method of removal. However, it is always advisable to make sure that the pH is high enough to afford a good degree of efficiency and, if necessary, a little nickel carbonate may be added.

CHROMIUM:

a. Except for other accidental causes, chromium is introduced by defective rack coatings where trapped chromic acid is carried from the chromium bath into the nickel bath. In our experiments, therefore, chromium was introduced as a dilute chromic acid solution (CrO_3).

b. 1. As the chromium concentration increases from 0 to 70 mg./l., the nickel deposit at low c.d. becomes very thin and then disappears altogether, and this unplated area spreads. At medium c.d., the plate becomes hazy and then milky, with streaks and a great many pits; finally at high c.d. it becomes black and powdery.

2. The absence of nickel deposit in low c.d. areas is quite noticeable at 40 mg./l.

3. The maximum concentration (x) for the appearance of the nickel plate can therefore not exceed 30 mg./l.

4. The solubility limit was not reached, as chromic acid is very soluble.

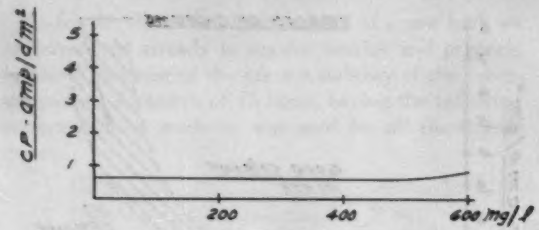


Fig. 7. Lead

c. 1. The curve in Fig. 6 shows that the CP varies little up to 30 mg./l. Beyond that point it increases suddenly, and the limit of the metal deposit becomes hard to determine. The upper curve corresponds to the identifiable chromium deposit; the shaded part to an area where, although it is not possible to locate it visually with any accuracy, some chromium is deposited as scattered spots; and the lower curve to the complete absence of any traces of chromium.

2. Therefore, we can also estimate the maximum concentration (z) for the covering power at 30 mg./l.

d. 1. Chelation by EDTA-Na_4 for 70 mg. of Cr per liter causes a definite improvement by restoring a little of the nickel deposit at low c.d. and by reducing the pitting at medium c.d., but the black, powdery area at high c.d. remains. To increase the chelating possibilities of chromium by EDTA-Na_4, Cr^{VI} must first be reduced to lower valences (Cr^{+++} or possibly Cr^{++}) but, even then, results are not wholly satisfactory.

2. On the other hand, by reducing Cr^{VI} to lower valences by the use of hydrosulfite (0.2 g./l. at pH $>$ 4), one can eliminate almost all chromium, which precipitates out as the hydroxides, $Cr(OH)_3$ or $Cr(OH)_2$. The quality of the nickel deposit is thereupon restored, together with the CP. However, it is advisable to check after this treatment and to rectify the concentration of the addition agents in the nickel bath, particularly that of the wetting agent, which is partially altered by the successive oxidation-reductions. Reduction by hydrosulfite at a high pH, therefore, is the simplest and most effective way of eliminating chromium.

3. Electrolysis is pointless, since chromium is alternatively oxidized at the anode and reduced at the cathode.

LEAD:

a. Lead can result from the chemicals, from pieces with soft solder or from parts of equipment in contact with the bath. Heavy contaminations by Pb are usually accidental.

In our experiments, lead was introduced as a $PbCl_2$ solution.

b. 1. By increasing the concentration of lead to 800 mg./l., we noted that the deposit became more and more hazy at low c.d., and assumed a reddish brown tone. At medium c.d., pits appeared resulting in large areas of thin deposit; and marked streaks formed at high c.d.

2. Strictly speaking, no absence of nickel deposit was observed until 800 mg./l., but streaks were quite clearly marked.

3. The maximum concentration (x) for the appearance of the nickel plate is in the vicinity of 150 mg./l.

4. The limit of solubility (y) in the nickel bath is in the neighborhood of 800 mg./l., at which point lead precipitates out partially as $PbSO_4$.

c. 1. The curve in Fig. 7 rises slowly, showing that the alteration of the CP is slight.

2. The concentration (z) may be estimated at 400 mg./l., but the nickel deposit is already unacceptable well before this figure is reached.

d. 1. Chelation by EDTA-Na_4 of 800 mg. of Pb per liter causes only a slight improvement, giving a better leveling and reducing the pitting somewhat.

2. Hydrosulfite (0.4 g./l.) gives better results than chelation, but the reddish brown area at low c.d. persists. Some of the lead is precipitated out as lead sulfate. In order to achieve a more complete precipitation, the solution would have to be acidified by the addition of H_2SO_4 before the hydrosulfite is introduced, then heated in order to cause decomposition and, finally, the pH would have to be raised by the addition of nickel carbonate; in this way precipitation of lead sulfate and hydroxide would be obtained.

3. Electrolysis is effective and efficient, but lead peroxide is formed on the anodes.

(*To be continued*)

POLISHING AND BUFFING OF ALUMINUM

(*Continued from page* 45)

Conclusion

No reference has been made to the relative merits of the different types of finishing equipment, leaving this to a meeting of minds of the supplier and ultimate user. In addition, there probably are other points relative to polishing and buffing of aluminum that could have been discussed. However, in the final analysis, acceptable finish should be produced on aluminum items if proper consideration is given to:

(1) The fabrication demands of the item to be produced.
(2) The surface condition after fabrication.
(3) The desired finish requirements.
(4) Proper abrasive selection and finishing techniques to produce the desired finish.

Last, but by all means not least, is that elusive, almost indescribable factor often lightly referred to as the human element, especially if hand-buffing is being employed.

One might watch a hand-buffing operation and think that there was little more to it other than the ability of the operator to live with not a little but rather with a considerable amount of dirt and grime. This is far from the truth, for there is such a thing as having the touch and feel of the buffing wheel. For the uninitiated who does not believe that this is true, the suggestion is made for him to try his hand at this apparently simple operation. When he does he will surely realize that no truer words were ever spoken than "That boy shure has some larnin' to do."

Automation Painting in Russian Machine Tool Manufacturing

By A. J. Steiger

CONVEYOR methods for automatic painting are being widely introduced in Russian machine tool manufacture for mechanized coating of both assembled units and separate parts, according to *Stanki i instrument* (Machine-tool and Instrument), the Soviet machine tool industry's leading technical journal.

In the manufacture of Russian machine tools, painting has heretofore been done by hand, except for partially mechanized enamel coating, a mere 5 to 7 per cent of the industry's painting work, the Moscow journal said in a survey article. Painting operations comprise 5 to 10 per cent of the labor invested in the making of a machine tool, it reported.

The painting conveyors thus enter a virtually new field in the Russian machine tool industry, replacing manual labor in a large way. Automatic methods are being introduced as the most effective in modern mass and serial production of machine tools, the Russian survey indicated.

"In a number of machine-tool manufacturing plants at present, the painting of assembled machine tools is being done on a walking conveyor of periodic operation," the journal said. "Painting on such a conveyor was first introduced at the Gorky milling machine plant, the Odessa radial machine tool works, at the Dmitrov and some other plants.

"An original flow line for conveyor painting of parts has been developed for the Gorky and Alapayev plants," the journal went on. "The conveyor is a chain, on which cages are suspended for carrying the parts being painted. To shorten the length of equipment used for drying the first coat of paint, a vertical design of drying chamber is adopted. The filler and enamel are dried during the conveyor's vertical travel. The conveyor's return under the floor is utilized for drying one of the ground coats."

An elaborate system of automatic painting is being developed at the "Red Proletarian" lathe plant, the Russian report indicated, describing what it termed a "circular conveyor of continuous operation with trolleys. Installed on the conveyor line are three compartments: in one, the first coat is applied by spraying, in the other two, heated enamel is applied. It is planned also to equip additional stations with appropriate mechanisms — polishing units, vacuum cleaners, and so forth."

The development of painting flow lines is sponsored by the research and planning bureaus of the USSR's machine tool industry, which have been looking into the whole field of the industry's painting work with the object of developing more productive methods. Every phase of painting work from washing and cleaning through methods of painting, including electrostatic, to ground polishing and shop ventilation are thus covered in the *Stanki i instrument* survey, described by the Russian authority *N. N. Kovalskiy*.

"The possibility of automation," Kovalskiy says, "depends to a large extent on preliminary finishing of the casting. The quality of chipping and cleaning of parts and the finish of surfaces scheduled for painting have substantial importance in this case." With this introduction, the author proceeds to discuss current painting operations in the machine tool industry as a whole.

Washing and Scouring

"An apparatus designed and installed at the Middle Volga machine tool works is used for washing parts, except for the machine bed, with petroleum solvent. The washing machine (Fig. 1) is a rectangular metal box divided vertically into two sections. The parts to be washed are fed into the upper compartment 1 through sliding side door 2 to the special trolley 3.

"Arranged in the machine's lower compartment is a tank for washing fluid, a draining funnel and a system

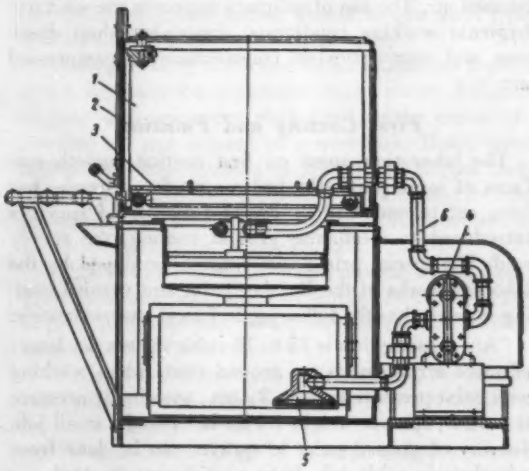


Fig. 1. Washing machine.

of pipes that feed and spray the washing solution. The fluid is drawn from the tank by pump 4 through suction socket 5 with filtering screen. In the machine's ceiling and side walls are perforated pipes fed from supply main 6, that wash the outer surface of parts."

Moscow research designers have developed a different washing machine for handling some machine parts, including the bed mount, the survey reports. Termed a "through pass machine with conveyor delivery of parts being washed," the machine operation is described. "During its passage through the apparatus, the part is washed from all sides by a solvent fed by circular pipes with perforations. After a three-to-five minute washing operation, the solvent supply is shut off and compressed air is turned on for drying the part and air-blasting remnant impurities from it.

"In this machine the flammable gasoline solvent can be replaced by soda ash solution. At the 'Red Proletarian' machine tool plant ground coated castings are being washed with an 0.6 to 0.8 per cent soda ash solution heated to 212°F."

Vacuum cleaning combined with air-blasting by compressed air is also a developed cleaning operation, the survey indicates. It said that "to the vacuum cleaner is attached a set of nozzles which are applied accord-

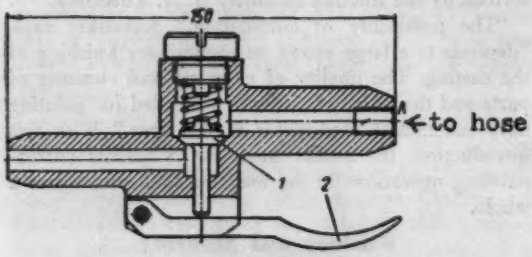


Fig. 2. Nozzle for hose.

ing to working conditions and part configurations. Vacuum cleaner power is 1320 watts, minimal discharge 1200 mm of water column, weight 70 kg (154 lbs.).

"In case a vacuum cleaner is lacking, special adapters (see Fig. 2) with valve 1 controlled by grip 2 should be put on the hose for air-blasting by compressed air. The use of adapters improves the sanitary-hygienic working conditions, diminishes shop dustiness and economizes on consumption of compressed air."

First Coating and Painting

The labor time spent on first coating smooth surfaces of large parts, the bed mount for instance, has been cut to one-third or one-half by use of sprayers introduced to mechanize ground coating, the survey said. The special prime coat sprayer developed by the Khotkov works of the Russian paint and varnish coating industry has the following technical characteristics:

"Air consumption is 15 to 18 cubic meters per hour; effective air pressure on ground coat, when working with paint-pressure tank, is 2 Atm.; system air pressure is 4 Atm.; sprayer weight 1.4 lb. In case of a small job, delivery of ground paint to sprayer can be done from a bucket; in a big job, from a paint-pressure tank.

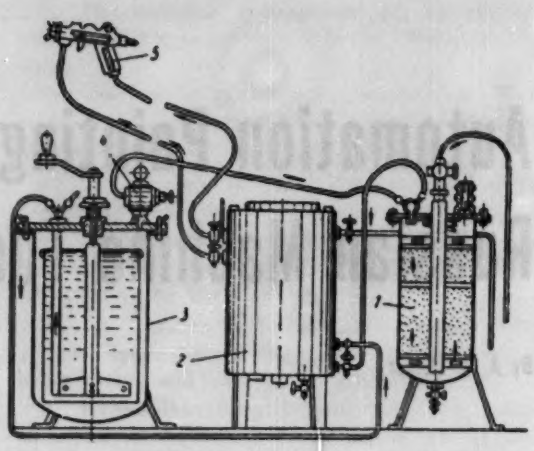


Fig. 3. Apparatus for applying hot enamel: 1—oil-water separator; 2—paint-air heater; 3—paint-pressure tank; 4—reducer; 5—sprayer.

"Application of heated enamel is an effective method of saving labor time and improving the sanitary-hygienic working conditions in painting jobs," the survey continued. "The essence of this operation consists in getting the necessary viscosity by means of heating it to 113 to 122°F. in a special paint-air-heater, instead of diluting the enamel with toxic and expensive solvents."

With the hot application method, it is sufficient to apply two, instead of three, coats of enamel and in addition, up to 30 per cent of the solvent is economized, the survey said. Ordinary spray guns, oil-water separators, and paint-pressure tanks are used in this painting method. But the paint-air-heater (Fig. 3) is a special device, described as follows:

"It is a metal vessel filled with water through which a steam pipe passes heating the water; the latter in turn gives off the heat to the enamel and compressed air that pass in tubes through the heated water. This unit is installed at the 'Red Proletarian' works for painting machine tools on a conveyor."

The painting of heavy duty machine tools is usually done outside a paint room, for the most part at assembly stations. On this point, the survey said: "in this case spray guns (Fig. 4) with diminished mist forma-

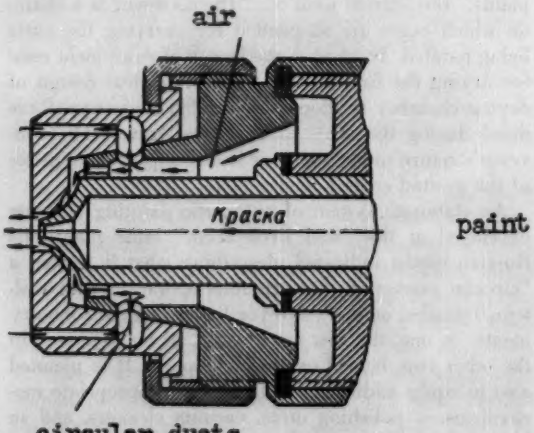


Fig. 4. Head of sprayer with reduced mist formation.

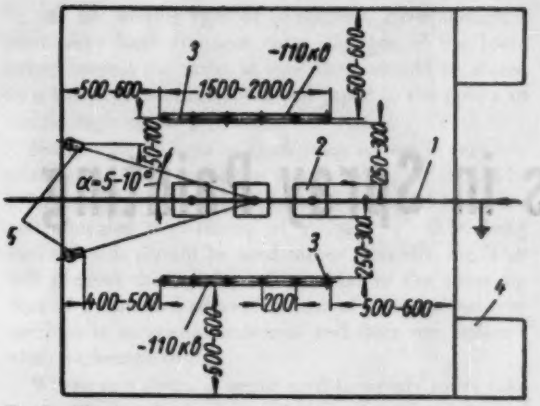


Fig. 5. Diagram of paint room with pneumatic sprayers: 1—conveyor; 2—work pieces; 3—electrode grids; 4—ventilation (suction); 5—sprayers.

tion are used. Reduction of mist formation is achieved by having in the spray gun head 12 additional air ducts one mm in diameter arranged concentrically around the sprayer nozzle. The air blowing out of these ducts creates a baffle zone which to a great extent eliminates the formation of mist."

Electrostatic Painting

The electrostatic method is rated "the most perfected process of painting" applied in the Russian machine tool industry. On the process advantages, the survey said: "Waste of paint and varnish materials is almost completely eliminated and their consumption is reduced 50 to 80 per cent. Labor productivity rises sharply owing to automation of the painting work. Coating finish is improved. Paint room design is simplified since filters and complicated exhaust ventilation are no longer necessary."

Electrostatic painting practice in Russian machine tool plants is described as follows: "Essentially, the work-piece being painted is an electrode in an electrical field of high voltage. The charged particles of paint settle uniformly on the part surfaces. In this process two methods of spraying the paint exist: by means of ordinary air sprayers and by means of centrifugal sprayers.

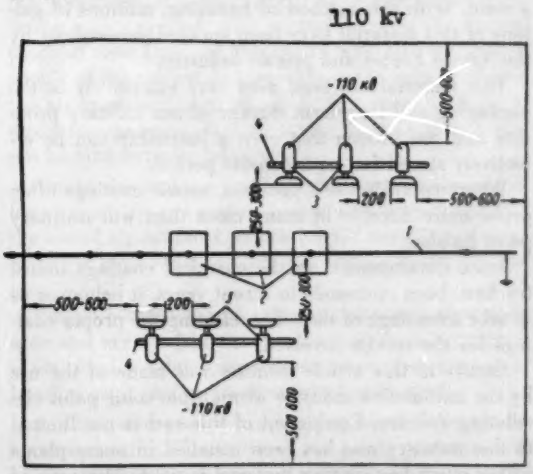


Fig. 6. Diagram of paint room with centrifugal sprayers: 1—conveyor; 2—work pieces; 3—sprayers; 4—stand for sprayers.

"Painting with use of air sprayers is done according to the system pictured in Fig. 5. The sprayers are installed on special stands spaced 16 to 20 inches from the electrode grids at various angles depending on the configuration of the work-piece being painted. The paint is sprayed face-on toward the conveyor travel. The sprayed particles of paint are charged at the electrode grids.

"Painting with centrifugal sprayers (Fig. 6) does not require electrode grids. The sprayer cups serve as electrodes and are rotated at a velocity of 3000 to 5000 rpm. Paint is fed to the cup center. The number of cups, their diameter and arrangement depend on the dimensions and configuration of parts being painted. The space between cups is not less than 8 inches, and from the cups to the surface being painted 10 to 12 inches.

"An air-turbine or electric-motor serves as the drive for the sprayers. The supply of paint is fed by special measuring pumps of the gear-mechanism type. Paint viscosity is, by viscometer measurement, 20 to 35 sec. for the cups, and 15 to 20 sec. for the sprayers.

"Painting in an electrical field can be used in applying the primer and final enamel, with exception of nitrocellulose, and other dangerously explosive paints, for which a spark-extinguishing mechanism is being

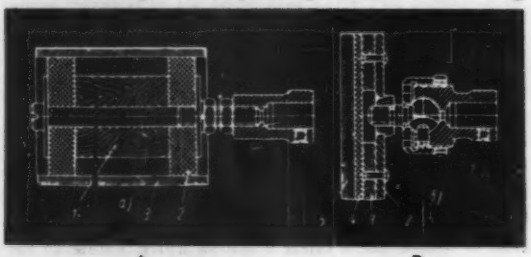


Fig. 7. Polished head units.

developed at present. Electrostatic painting is now installed at the Gorky milling machine plant for priming parts of sheet metal. In addition to its many other advantages, electrostatic painting greatly improves the sanitary-hygienic working conditions."

Polishing Ground Coating

The equipment used in the Russian machine tool industry to mechanize the polishing operation consists mainly of motorized buffing wheels, of two main types. The survey gives the following picture:

"Polisher No. 1 is formed of an aluminum body in which is mounted a pneumatic rotary motor. Polishing is done with an emery cloth fixed to the center of a circular felt pad dressed on a steel disk. Motor power is 0.75 hp when rotating at 1800 to 1900 rpm under load. Weighing 6 lbs., the polisher is actuated by compressed air from a system under 4 Atm. pressure; air consumption is 1 cu.m. per minute.

"This polisher is somewhat modified at the Leningrad automatic machine tool works. To the steel disk is fixed a rubber pad with pieces of pumice stone attached to it.

"Polisher No. 1 has been put into use at the machine tool plants Imeni Ordzhonikidze, Imeni Sverdlovsk, Lenstankolit and others.

"Polisher No. 2 (Fig. 7) is employed to mechanize

(*Continued on page* 55)

Pumps and Their Uses in Spray Painting

By J. Arthur Weed

IN a previous article the writer mentioned the use of positive displacement pumps for the handling of paints, solvents, etc. The reference was, of necessity, very brief, and a more elaborate treatment of this very important subject will be described here.

Larger users of paint, such as the automotive industry, have used pumps for paint circulating systems for many years. Such pumps were driven mainly by electric motors and were designed to withstand the abrasion present in most paints, whether prime or finish coating materials.

With the many colors used to paint the modern automobile, it involved the use of a separate unit for each color used, and in many cases there were in excess of 20 separate circulating systems. Handling of the paint from the shipping container presented quite a problem, involving the use of elaborate lifting mechanisms. Due to improper handling techniques, as much as 1-2 gallons of usable paint often is left in a dried state in the shipping container.

A number of years ago a company conceived the idea of using the original shipping container for the storage and pumping of the paint. While the basic idea was good, the sales resistance was tremendous. All sorts of arguments were put forth, first that the paint company would not ship material mixed to spraying viscosities, second that the paint would settle out in the recirculating lines to the spray booths, again that the material would dry in the lines and how would the poor user ever get them clean, and many other excuses as to why they should not buy such ridiculous equipment. Time has proven such arguments to be wrong, and today there are tens of thousands of such units in use, pumping many food products, adhesives, sealers, paints, and other difficult to handle items with ease.

As mentioned in a previous article, the pumps that were manufactured in the early days left much to be desired, but pumps manufactured today are as precision equipment should be.

Gear type pumps are excellent in the handling of some type of materials but they do not have a place in the handling of paints or other products of an abrasive nature. The early pumps used in the handling of paints from the original container were of the gear type and were driven by an air motor. It follows that such units had a very short life and, in many cases, the purchaser was so discouraged with their performance that he almost gave up the very good idea of pumping his paint.

Realizing that they had a good basic idea, manufacturers of this type of equipment spent a large amount of time and money developing pumps that would withstand the abrasiveness of all sorts of paints.

One of the first uses for reciprocating type pumps was the handling of heavy, mastic materials such as used in the spraying of the underside of automobiles. Pressure tanks were first used for this operation, but the air operated pump proved so much more practical that many thousands were sold for this purpose. All that the user had to do was insert the pump in the material container, connect his air supply and he was ready to work.

With the success experienced in the spraying of mastics for this purpose, it was natural that the same pumps would be used in the spraying of other types of heavy coatings that could not be handled by pressure containers. This opened up an entirely new field, and there are many materials of a heavy fluid nature which are currently pumped in this fashion.

One particular case was the spraying of vinyl plastics, where the user wanted to increase the amount of solids in the material and could not do so and be able to spray it by conventional means. This material being thixotropic, it was necessary to reduce the viscosity by agitation rather than thinning. By use of an air operated agitator and pump, the user was able to spray a material, that at lower temperatures almost approached a solid. With this method of handling, millions of gallons of this material have been sprayed successfully by the Armed Forces and private industry.

This material has been used very extensively in the packaging and long term storage of our military products and has proven that even a battleship can be effectively stored for an indefinite period.

Where corrosion is a problem, mastic coatings often prove more durable in many cases than will ordinary paint finishes.

Since developments in the chemical coatings industry have been numerous in recent years, it behooves us to take advantage of these for selecting the proper coatings for the service involved.

Earlier in this article mention was made of the use by the automotive industry of multiple color paint circulating systems. Equipment of this sort is not limited to this industry and has been installed in many plants where much less coating material is used. Any user of paint can benefit from the savings that can be effected

by the use of this type of equipment. Even though a plant may have frequent color changes, if the basic colors remain the same, at least these should be stored in a fire-proof storage room and piped to the points of use throughout the plant.

Installation of a paint circulating system is very important and there are a few simple rules that should be followed. First, never use pipes for the fluid lines, use soft annealed steel tubing of at least ⅞" O.D. Long radius bends should be used rather than ells, etc. This will prevent the buildup of material in the short radius of a standard elbow. The use of compression connections is somewhat universal and their use makes a neat, workmanlike job.

Where one pump is being used to supply more than one spray booth, it is essential that some method of fluid pressure regulations be furnished at each spray booth. The line pressure in the circulating system should be maintained at a high enough level so that each booth may regulate the correct spraying pressure for its operation. This is accomplished by means of a back pressure valve that is mounted at the pump and which restricts the recirculated material to provide the necessary pressure and volume in the lines.

The use of air operated pumps is not limited to the paint handling field by any means and there are literally thousands of pumps used in the handling of adhesives, food products, printing inks, etc.

For products that are heavier in viscosity than normal, in other words materials that will not flow, or seek their own level, air operated pumps have been used with forced induction plates or rams that will keep the units constantly primed. Adhesives such as used in the acoustical tile industry have been handled by pumps of this type and great savings have resulted from their use. They are also used for the packaging of very viscous materials. Such an air operated pump will stop on what is called "back pressure." When the fluid being pumped is shut off, the pump will stop and not resume operation until the fluid control valve is opened. This makes possible remote control operations, the pump being installed in a storage area and a fluid outlet or control in some other area of the plant.

Where highly flammable solvents are used in painting operations, it is often practical to pipe the material to the points needed, with control valve at the desired point of use. Opening this valve will give an instant supply of the solvent and, as soon as the valve is closed, the air operated pump will stop. The valve used at the outlet should be of the self-closing type so that it cannot be inadvertently left open.

Companies making products that require the use of heavy caulking and sealing compounds have found that the use of air operated pumps for the handling of these products have reduced costs and helped speed production.

Pumps constructed of stainless steel are also available and are used in the handling of various types of acids, food products, and other items that cannot be handled with pumps constructed of mild steel.

Air operated pumps are built in many different designs and ratios. The ratio of the pump determines its ability to handle materials of different viscosities. For example, if one desires to pump a solvent and obtain a large volume delivery, a pump with a ratio of one to one would accomplish the job. With materials of a heavier nature, pumps with ratios of as high as 80 to 1 may be required. As the ratio of the pump increases, the volume of delivery decreases, so that one contemplating using pumps of this type should consult with his supplier to determine the right one for his needs.

It must be stressed, that when using air operated pumps, a clean adequate source of compressed air be available. It is also wise to use a line oiler after the air has been filtered to insure proper lubrication of the pump. Where pumps of this nature are used at below freezing temperatures and the compressed air has a tendency to freeze in the line, injectors containing antifreeze compounds have been used to keep the units operating.

AUTOMATION PAINTING

(*Continued from page* 53)

polishing of irregularly shaped surfaces. It consists of two head units attachable to the spindle of a pneumatic drill with 0.25 hp. motor and rotation velocity of 1000 rpm under load. The unit shown in Fig. 7A consists of wood roller *1* and two felt disks to which are glued emery paper *3* in the form of a band 2½ inches wide.

"The head unit shown in Fig. 7B consists of ball-and-socket hinge *1* and polishing wheel. The wheel has a metal base *2* to which are fixed disks of plywood *3* and cloth *4*. The emery wheel *5* in the form of disks 3 inches in diameter and up to 30 in number is glued to the cloth disk. The hinge permits turning the polishing wheel at various angles. The overall weight of drill and heat unit amounts to 4.6 lbs. Air consumption is 0.5 cu.m. per minute."

Ventilation in Painting Heavy-Duty Machine-Tools

"At the Kolomna plant a special wing, equipped with supply-exhaust ventilation, has been installed for painting heavy-duty machine-tools," the Russian survey said, indicating it was designed by industry research planners. "It is equipped with four supply-heating units, each consisting of an axial explosion-proof ventilator with productive capacity of 23,000 cu.m. per hour, a heater and 8-kw electric motor.

"On one side of the wing are installed six exhaust units, each consisting of an axial explosion-proof ventilator with productive capacity of 23,000 cu.m. per hour, a 7-kw electric motor and a hydro-filter with a pump run by an 8-kw electric motor. An air screen is installed at the doors. This wing is, as it were, a large paint room.

"In painting heavy duty machine tools it is now planned to develop more effective ventilation outside the room, by installing exhaust grating at the floor level, and arranging hydrofilters under the floor. Along the walls are to be installed supply pipes with bent outlets that direct the air straight at the machine tools being painted. Under such a system of ventilation, all of the contaminated air will go out under the floor, bypassing the breathing zone of the worker engaged in painting. The worker will at all times be in the zone of fresh air brought in by the supply ventilation."

Finishing Zinc Base Die Castings

By Lester Spencer, *Finishing Engineer, West Allis, Wis.*

This is the second and concluding part of this article. Part I appeared in the November issue.—*Ed.*

Protective and Decorative Coatings

Protective and decorative coatings for zinc-base die castings fall within the following categories, namely: (a) electrodeposited metallic coatings; (b) electrodeposited non-metallic coatings; (c) chemical treatments; (d) organic finishes; and, (e) plastic finishes. A number of the more important coatings are discussed.

Although all of the metals usually electrodeposited can be used as a coating for zinc-base die castings, coating combinations of nickel or of copper and nickel, on which a relatively thin layer of chromium is deposited are the most frequently employed. The deposition of nickel directly onto a zinc die casting may be quite successful provided that the casting is relatively simple in shape not requiring high throwing power;[5,6] a number of solutions formulated for this purpose being commercially available.

Virtually all zinc die castings require a copper strike prior to entry into the copper plating bath. Strike solutions should be maintained just as carefully as plating solutions, this preferably including a filtration system and treatment with activated carbon, close control of metal content which may build up excessively, particularly when copper anodes are employed, and avoidance of contamination. In the latter instance, castings that have completed the pre-clean and cleaning cycle should be thoroughly rinsed prior to their entry into the copper strike. Another source of contamination is that of dissolved chromium from the plating racks; more than 0.05 to 0.1 g./l. causing trouble.[7] Sodium hydrosulfite in small amounts (¼ to ½ oz./100 gallons of strike solution) may be used to reduce chromium compounds to the harmless trivalent state. Excessive amounts will cause a copper sulfide precipitation and subsequent roughness. For most operations, the following composition and operating conditions[7] are satisfactory.

Copper (metal)	1½ to 2 oz./gal.
Copper cyanide	2 to 3 "
Sodium cyanide (Free)	1 to 1½ "
pH	11 to 12
Anodes	Copper
Anode to cathode area	2 to 1
Cathode current density	20 to 25 amp./ft.^{2}
Temperature	110 to 140°
Time	1 to 3 minutes

Potassium cyanide may be used in the above formula. It will be more expensive than sodium cyanide but eliminates a rinse prior to plating in a high speed potassium bath. The deposit thickness required will be dependent to an extent upon the copper plate bath used; however, in general, if the deposit from the strike is too light, the copper plate may blister; if it is too heavy, the final deposit may lack luster.

The precautions stated above apply equally as well to the copper plating bath. Although both the conventional cyanide and Rochelle salt type baths may be employed, the trend has been to the high speed copper baths. These plating baths, which are usually covered by patents, are characterized by a high metal concentration, a low free cyanide content, a relatively high operating temperature, a prerequisite of agitation, and an efficiency at or close to 100 percent. Table 3 gives the relationship of deposit thickness as a function of current density and time.

Since these baths vary to some extent as to operating conditions, it may be well to outline some of the highlights of these baths. For details, it is suggested that detailed instructions be obtained from the vendor. One supplier recommends operation with periodic reverse current to obtain many of the advantages along with a minimum of both "roughness" of plate and a condition known as "blush." Some baths permit carbonates up to 10 oz./gal.; one process does not emphasize carbonate control; whereas, another bath permits operation with carbonates up to saturation.

Organic contamination, which may be a source for pitting, is controlled to some extent by the use of a wetting agent, or by carbon treatment. Both hexavalent chromium and zinc are considered objectionable. As mentioned previously, hexavalent chromium, which is reputed to lower adhesion, reduce efficiency and affect the bright range, is reduced to the trivalent state by sodium hydrosulfite in some baths. Zinc, in fairly high concentrations, will also affect the bright range of a number of solutions; in some cases it may be precipitated with sodium sulfide, while others use a proprietory addition agent to tie both the zinc and the chromium. An alternate procedure in one case involves precipitation by absorption on special grades of calcium hydroxide.

One of the objections given to these high speed baths is the roughness of deposit; the methods used to rectify this condition being the use of anode bags or anode diaphragms. Ostrow and Nobel[10] consider anode bags far from desirable since they do not permit solution movement about the anode, and are conducive to the formation of anodic films which will require excessive

TABLE 3

Thickness of Copper Deposited in Minutes Based on Cathode Efficiency of 100%

Thickness Inches	Amperes per Square Foot 25	30	35	40	45	50	55	60	70
0.0001	2:07	1:46	1:36	1:19	1:10	1:04	0:59	0:53	0:45
0.0002	4:14	3:32	3:12	2:31	2:20	2:08	1:56	1:53	1:30
0.0003	6:21	5:18	4:48	3:57	3:30	3:12	2:55	2:46	2:16
0.0004	8:20	7:34	6:24	5:16	4:40	4:16	3:55	3:37	3:01
0.0005	10:36	8:50	7:40	6:20	5:50	5:20	4:50	4:26	3:47
0.0006	13:00	10:36	9:36	7:54	7:00	6:24	6:15	5:22	4:32
0.0007	15:00	13:00	10:36	9:13	8:10	7:28	6:42	6:13	5:16
0.0008	17:00	14:00	13:00	10:36	9:20	8:32	7:45	7:07	6:02
0.0009	19:00	16:00	15:00	12:00	10:36	9:36	8:43	8:00	6:48
0.001	22:00	18:00	17:00	13:00	12:00	10:36	9:38	8:50	7:32
0.002	44:00	36:00	34:00	26:00	24:00	21:00	19:06	17:40	15:06

Current densities of 5 to 40 amp./ft.^{2} are generally used, although much higher current densities may be employed depending upon the metal concentration, bath temperatures and rate of agitation.

voltage to maintain a given current density. This latter condition may eventually lead to complete anode polarization. Some processes utilize anode diaphragms of several designs, but they have the disadvantage of being quite cumbersome and costly.

In plating zinc die castings with high speed copper, full advantage may not be taken of the full brightness obtainable with these baths. Thus, the bath is frequently operated to yield a semi-bright copper so as to obtain a slight matte effect to mask minor surface defects without preventing the development of a good luster of the subsequent nickel plate.

It is possible to plate nickel directly on the zinc surface, but the coating thickness is usually limited to about 0.0005" to prevent cracking of the deposit. One difficulty experienced is that zinc may dissolve in recesses when plated in ordinary nickel solutions and then co-deposited with nickel to form a black, streaky deposit. This occurs when the zinc content of the solution reaches a critical concentration. The condition is repressed by the addition of sodium sulfate, a suggested formulation which has proven successful being as follows:

Nickel sulfate	10-15 oz./gal.
Anhydrous sodium sulfate	10-15 "
Ammonium chloride	2-3 "
Boric acid	2 "

The sodium sulfate addition in the above formulation is dependent on the complexity of the shape to be plated; a 10 oz./gal. concentration being employed for relative simple shapes, whereas, a concentration of 15 oz./gal. is recommended for the most complex shapes. In some shops, a nickel sulfate concentration of 24 oz./gal. may be used, but there is an increasing danger that the plate may crack. As a general rule, it is best to adjust the nickel sulfate content to the minimum which will produce a satisfactory plate. Both the pH and the current density will depend on the nickel salts content. A pH of 5.3 to 5.7 is used at a nickel sulfate concentration of 10 oz./gal., whereas, a pH of 4.9 to 5.4 is suggested for a bath containing 15 oz./gal.

As to current density, 12 to 20 amp./ft.^{2} is acceptable for baths of lower nickel content. This value is increased from 24 to 36 amp./ft.^{2} at high nickel concentrations. Agitation is usually recommended since it tends to reduce porosity and, frequently, permits the use of a higher current density. Hydrogen peroxide is used to overcome any pitting tendencies of the bath, but this chemical should be used with caution since an excess may cause cathode polarization, resulting in a black and brittle plate. Carbonates also tend to produce a brittle plate which dictates the exclusion of air agitation. Bath operating temperature is between 70 and 80°F.

The deposition of chromium plate may be employed directly on the surface of a zinc die casting.[13] However, it is usually limited to where the service conditions are relatively mild. Where severe service is anticipated, as for outdoor exposure, the combination copper and nickel plate underneath a final chromium deposit is recommended. The minimum coating thickness of this combination of three types of finishes, as given by ASTM, is tabulated (Table 4). A typical cycle on an automatic basis has been reported by Horvick.[4] The essential facts of interest would include: (a) initial spraying of buffed castings with a mineral spirit to avoid hardening of the buffing compound; (b) precleaning cycle on a semi-automatic basis; (c) an automatic plating cycle of 21 stations, the details of which are given in Table 5; and, (d) the use of force drying after plating has been completed.

TABLE 4

Electroplated Finishes for Zinc Die Castings (ASTM Desig. B142-41T)

	THICKNESS OF COATING TYPE FZ	TYPE KZ	TYPE QZ
Copper plus nickel, min.	0.00125"	0.00075"	0.0005"(a)
Copper, min.	0.00040"	0.00030"	0.0002"
Final nickel, min.	0.00050"	0.00030"	0.0003"
Chromium, min.	0.00001"	0.00001"	0.00001"

(a) Total of 0.0003" if alternate of nickel is used.

Note:—Upon agreement between manufacturer and purchaser, copper may be omitted in types FZ and KZ provided the minimum thickness of nickel is equal to the minimum stated above for the combination of copper and nickel. This alternative is also permitted in type QZ without prior agreement. All minimum values apply to significant surfaces agreed upon by both supplier and purchaser.

Type FZ finish is the highest electroplate, while type KZ is the one most usually applied for outdoor and general service. Type QZ is recommended for interior use.

TABLE 5

Automatic Plating Cycle for Zinc Base Die Castings

Operation Type	Time	Rack Space	Length
Anodic clean	46 sec.	3	62 in.
Warm rinse and spray	10 "	1	22 "
Cold rinse and spray	10 "	1	22 "
Acid dip	10 "	1	22 "
Rinse and spray	10 "	1	22 "
Copper strike	154 "	6	132 "
Copper plate*	623 "	19	396 "
Warm rinse and spray	10 "	1	22 "
Cold rinse and spray	10 "	1	22 "
Acid dip	10 "	1	22 "
Rinse and spray	10 "	1	22 "
Nickel plate**	730 "	22	467 "
Rinse and spray	10 "	1	22 "
Acid dip	10 "	1	22 "
Rinse and spray	10 "	1	22 "
Chromium plate ***	118 "	5	102 "
Dragout	10 "	1	22 "
Rinse and spray	10 "	1	22 "
Rinse and spray	10 "	1	22 "
Hot rinse	10 "	1	22 "
Load and unload	82 "	4	79 "
Drier****	240 "	–	264 "

*Bright; PR ratio 6:1; temperature 140°F.; C.D. 20 to 25 amp./ft.^{2}; and deposition rate of 0.0001" in 3.5 minutes.

**Bright; temperature 140°F.; C.D. 60 amp./ft.^{2}; and deposition rate of 0.0001" in 2 minutes.

***C.D. 120 amp./ft.^{2}; operating temperature 110°F.

****Operated at 400°F.

Chemical Treatments

Zinc die castings may be treated either by a simple immersion for short intervals of time in certain chemical solutions, or by an electrolytic treatment, to obtain a decided color. While these coatings, especially those that are produced electrolytically and which are reputed to be quite hard and abrasion resistant, may serve a dual purpose of corrosion protection and decoration, they are more widely used for bonding of organic finishes. The great majority of these processes are proprietory compounds and precise operating and performance data should be obtained from the supplier of the process selected. However, information can be given which may aid in the selection of a suitable process.

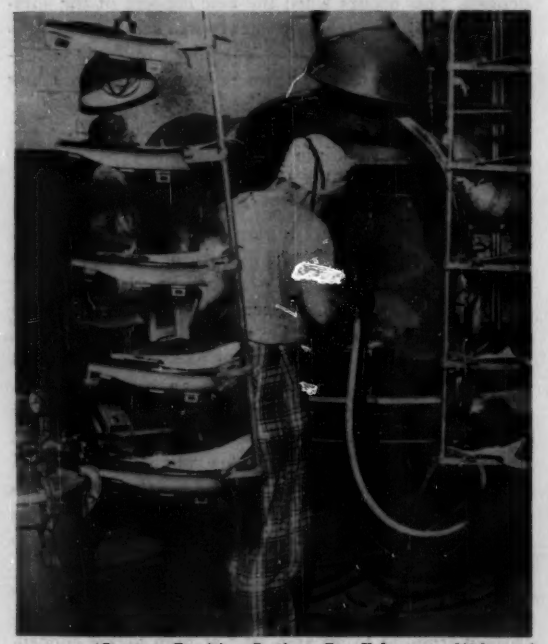
A chromate conversion coating is produced by immersion in a dichromate or chromate bath containing suitable activators. The film may range in color from an iridescent yellow to bronze and olive drab. Leaching of the iridescent yellow with a mild alkaline solution has been reported;[14] the resultant finish being a bright, clear, bluish-white film similar in appearance to chromium plating. The approximate operating limits[11] would include a pH of 1.0 to 3.5; an operating temperature of 60 to 110°F.; an immersion time generally ranging from 15 to 45 seconds, although certain treatments may require up to 10 minutes immersion; and, a hexavalent chromium content that may be variable depending upon the formulation.

The use of an acidified dye bath, utilizing certain alizarine and diazo dyes in a solution of a pH value from 3.5 to 4.5, will color the above coatings. It is essential that this operation be performed while the coating is freshly formed and wet to obtain satisfactory color absorption. The olive drab coatings may be dyed jet black or dark shades of red, blue, and green, whereas, both the bronze and the yellow coatings may be colored to the lighter shades of red, blue, and green. Although a hot rinse is essential after applying a chromate coating to obtain a tough, flexible structure, it is objectionable when coloring since leaching may occur.

A single dip for the purpose of obtaining a black effect can also be included within this group; this coating is of moderate protective value obtained directly from a chromate bath without the use of a subsequent dyeing treatment. In all of the chemical treatments described, it is essential that the casting be thoroughly cleaned prior to treatment.

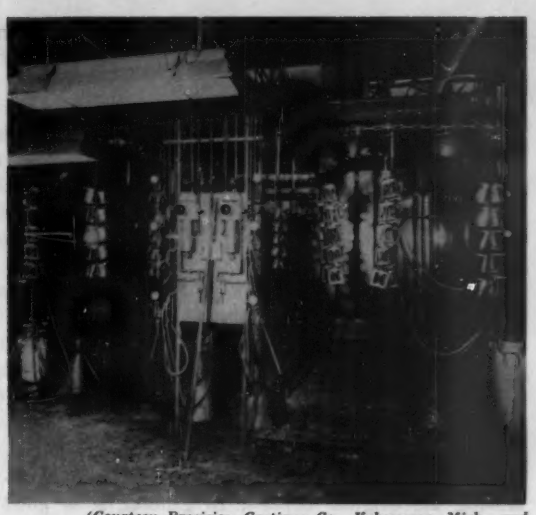
The use of an electrolytic process to obtain either a yellow or black coating is used to some extent, this type of coating being harder and less subject to removal by abrasion[11] when freshly formed as compared to the non-electrolytic coatings. Operating conditions reported to produce a yellow iridescent film, that may be bleached to a silvery pastel iridescence, would include a pH of 5.5 to 6.0; a voltage of 1.5 to 4.0; a current density varying from 5 to 50 amp./ft.^{2}; and a treatment time of 1 to 5 minutes. The anodically produced black film would require a solution pH between 2.5 and 4.5; a voltage of 1.5 to 3.0; a current density range of 10 to 20 amp./ft.^{2}; and, a treatment time from 2 to 10 minutes.

Phosphate coatings, which are usually used as a preparatory coating prior to painting, consist of a dense layer of non-metallic crystals bonded to the metal surface. These coatings, which are applied either by brush, spray, or dipping procedures, may be pro-



(Courtesy Precision Castings Co., Kalamazoo, Mich., and American Zinc Institute, New York, N. Y.)

Automobile die castings being spray painted.



(Courtesy Precision Castings Co., Kalamazoo, Mich., and American Zinc Institute, New York, N. Y.)

Zinc die castings being painted in electrostatic spray paint system.

duced either in a three or five stage cycle. A three-stage cycle would include (a) spraying the proprietary solution for 1 minute at 140°F.; (b) a cold water spray rinse for one minute; and, (c) a mild chromic-phosphoric acid rinse for about 30 seconds at 140°F. Forced air or oven drying usually follows. The five stage process is similar to the above with the exception that the work is initially cleaned in either an alkaline or emulsion solution for about one minute followed by a hot water rinse.

Organic Finishes

Zinc base die castings are capable of being finished in a wide variety of organic finishes and combinations, which are used primarily for decoration and sales appeal. For this purpose there is available an endless range of colors and textures in lacquers, enamels, and paints. Combinations of lustrous or butler chromium plate with variously colored enamels are being used effectively. Assemblies of bright chromium plated zinc die castings with brilliantly colored plastics is another way to produce attractive results.

Good adhesion cannot be expected unless the metal surface is thoroughly clean. The use of chemical pretreatment is especially effective in obtaining a bonding action. However, in the event of a phosphate coating, excessive film thickness may require additional coats of an enamel to satisfy the absorptive properties[8] of the phosphate coating and ensure a finish of the desired appearance. Organic coatings commonly applied are either an air drying type, or one that is forced dried or baked; the latter type is the preferred since the coating is considered more adherent than that obtained with an air drying type. In the event that a baked finish is employed, it is essential that some attention be given to the baking temperature and its effect on the relatively low-melting-point zinc alloy. Maximum baking temperature as a function of time for both ASTM alloys XXIII and XXV would include: (a) at ½ hour baking time, the maximum baking temperature should be 425°F.; (b) a 1 hour baking time at 375°.; (c) a 2 hour baking time at 325°F.; and, (d) a 3 hour baking time at 300°F.

The use of a primer coat will depend upon the finish coat selected, but it is generally accepted that a primer coat is advisable where severe service conditions are anticipated. The major prerequisite of a primer coat is that of compatability with both the basis metal and the finish coat selected. Some of the ingredients of the primer will materially aid in obtaining maximum serviceability of the finish coat. Of these, it has been stated[12] that both zinc chromate and ferrous ammonium sulphate suspended in a synthetic resin are particularly resistant to both moisture and chemical attack. Metallic aluminum has been used under metallic type finish coats, whereas, alkyd base primers are also considered as effective primers. A few comments on the major types of organic finishes for zinc base die castings can be given.

The lacquer enamels, which produce a tough, durable, one-coat finish, are available in a variety of colors. Although this finish can be applied over the raw casting, it is essential that a chemical pre-treatment be employed where outdoor or similar severe exposures are anticipated. Normally a primer coat is not required. The finish coat will air dry in about 5 to 10 minutes with the coating completely hard within 1 hour.

The vinyl resin coatings are noted for their durability. However, in order to realize the top performance of this synthetic coating type, it is essential that both a chemical pretreatment and a suitable primer be used prior to the application of the finish coat. The primer may be either an air-dry wash or special baked primer. The final coat is baked at about 350°F. for about 15 minutes. One of these coatings has been reported[12] to have an appearance similar to that of Morocco leather, which effectively masks minor surface defects. These coatings, which also are available in most colors, are highly resistant to both chemicals and abrasion.

Another baked, synthetic finish is the epoxy resin coatings that are reputed to be highly resistant to corrosion and abrasion and, in addition, have good adhesion when sprayed on the raw casting. Neither chemical pretreatment nor a primary coating is required. The final coating, which is available in a choice of colors with a smooth, hard and glossy appearance, is baked around 350°F. for about 30 minutes.

That broad classification known as "the enamels" can be applied as a multi-colored finish providing an excellent masking of minor defects on the surface of the casting. These coatings have excellent abrasion, chipping, and cracking resistance and, in addition, can be repeatedly washed with soap and water, or scrubbed with an abrasive cleaner. The use of a chemical pretreatment will be dependent upon the anticipated service, a special 3 hour air dry primer is recommended, and the final coat is air dried in about 30 minutes and can be handled in about 3 hours. The final coat may also be forced dried at about 200°F. after it has air dried to the touch.

There are certain formulations of the enamel type which pucker slightly upon drying; the resultant finish being known as a "wrinkle type" that is extensively

(Continued on page 63)

Stripping Metallic Coatings

By J. B. Mohler, *Consultant; Seattle, Wash.*

MANY methods have been devised to strip electrodeposits from various basis metals. The methods have been collected and tabulated for ready reference.[3] However the removal of the surface metal from the basis metal is often less than satisfactory. This is due to the fact that stripping methods have been devised to satisfy differing needs. A deposit is often stripped so that the part may be replated. Deposits are also stripped to determine their weight. If stripping is quantitative and without attack of the basis metal, then this is done by weighing the part, or a section of the part, stripping and reweighing. Or the deposit may be stripped and the amount of metal removed then determined by quantitative analysis of the stripping solution.

At times it is vital to salvage an improperly plated part. This is particularly true when the part is expensive and the plating is defective. At other times it is good economy to strip and replate used parts such as chromium plated tools and dies.

Routine salvage of plated production parts is undoubtedly good practice but not in every case. If a salvage department is set up it should be kept in mind that it is *salvage* and it should be recognized as such. Although the salvage department may be operated as a production department, and should be run according to good production practice, it really is a department that is making good work from *scrap*. If this is not kept in mind, salvage can cost more than the value of the salvaged work. In one case it was found that the salvage department was very busy. On investigation it was found that all scrap was being routed to salvage with the result that some parts had gone through salvage six times and were still scrap. Again it has been found that the amount of scrap increased after a salvage department was set up because of the attitude that scrap could be saved by the salvage operation. These experiences point up the fact that it may be better to scrap defective plating than to try and save it.

If salvage methods appear to be economic, they should be applied to produce parts that will pass inspection standards for new work. First we should determine the cause of the defects. If faulty plating, for instance, is due to porous basis metal, the replated parts will also be faulty. However, if the faults are due to poor racking at the plating step, they can be replated. Stripping of the plated work is not always necessary but the original deposit must not be flaked, blistered or burnt if it is to be replated without removing the original deposit. In general, it is good practice to strip the deposit when this can easily be done. Deposits can be stripped mechanically, chemically, or electrochemically. If the deposits are thin, they may be removed merely by buffing and polishing and the work can then be replated. Heavy chromium deposits on worn shafts are often removed by grinding. Chemical or electrochemical stripping methods, on the other hand, are frequently cleaner, faster, and more economical.

General Stripping Methods

Deposits can often be stripped by reversing the current in the plating tank. Silver can be stripped from steel in a silver plating bath or a silver strike. However, if this is done to excess, it will decrease the silver in solution and increase the free cyanide in the silver bath, or it will increase the silver in a strike. This should only be done as an emergency measure, as should stripping of chromium in a chromic acid bath or nickel in a nickel bath. Stripping nickel by such a method can be very unwise since an iron or copper basis metal will readily contaminate a nickel bath. It is best to strip metals electrolytically in a separate stripping tank.

A 5% sodium cyanide solution is a good general electrolytic stripping bath. Brass, bronze, cadmium, copper, gold, and silver can be stripped by this means. Thin deposits can be removed rapidly at 6 volts. If the deposits are heavier they will polarize before they are removed so that it is better to strip at a lower voltage. Two volts has been found to be a good general voltage for stripping of heavy deposits by this method.[2]

An acid that will form a soluble salt of the metal being stripped can be used as an electrolytic stripping bath. A bath of 5% hydrochloric acid is a good general solution to strip a number of metals. A similar solution of cold fluoboric acid is also good. Base metals such as cadmium, zinc, lead, and tin can be stripped from noble metals such as copper or silver by this method. The stripping action will be confined to the base metal until it is stripped and, thereafter, will begin to remove the noble metal. Therefore, it is necessary to observe the stripping action and to remove the work as soon as stripping is complete.

Methods have been developed to strip specific de-

posits from a particular base. Many of these are reliable and widely used, such as electrolytic stripping of silver from steel in a cyanide solution. Others are little more than a recommendation and may work for thin deposits but not for heavy deposits. For example chromium can be stripped from steel electrolytically in almost any alkaline solution such as an available electrolytic cleaner. However, this method works well only on thin deposits.

Proprietary formulations have been developed that are reliable. Many of these are simple, convenient, immersion methods and, as such, are preferred to processes that are unreliable. It is often necessary to do a considerable amount of experimentation to develop details of a production stripping process.

Quantative Stripping

Cyanide-soluble metals can be stripped quantitatively from steel by electrolytic means. Stripping is done by anodic cyanide treatment and additions of sodium hydroxide will aid in the stripping of zinc, cadmium, and brass. Blum and Hogaboom have tabulated a number of electrolytic and immersion methods that will strip many metals with an accuracy of ± 10%.[3] Ollard and Smith also describe a number of similar methods for the same purpose.[4] Many of the quantitative methods can also be used for salvage stripping. A listing of recommended methods taken from authoritative sources is given below.

BRASS FROM STEEL:

1. Anodic cyanide or alkaline cyanide at 2 volts. Current density 10 to 20 amp./ft.^{2} The solution may be warmed to increase the stripping rate.

2. Brass can be stripped by immersion in ammonia-peroxygen solutions. Solution life is short due to rapid decomposition of the peroxygen compounds.

a. Ammonium persulfate	10 oz./gal.
Ammonium hydroxide	3 pints/gal.
b. Ammonium hydroxide	5 pints/gal.
Hydrogen peroxide (100 vol.)	3 "

CADMIUM FROM STEEL:

3. Cadmium can be stripped from steel by immersion at room temperature in a noble metal-hydrochloric acid solution. Antimony oxide or antimony perchloride will provide a source of noble metal. A smut is formed during the action that must be wiped from the work.

Hydrochloric acid	1 gal.
Antimony trioxide	2 oz.
Water	½ pint

4. Ammonium nitrate ..... 1 lb./gal.
Immersion at room temperature.

COPPER FROM ZINC AND MAGNESIUM:

Copper can be stripped from non-ferrous metals by immersion in alkaline polysulfide solutions. Sulfide deposits form that can be removed by immersion in cyanide solutions. Heavy deposits of copper are treated alternately in polysulfide, then cyanide. Brush if any deposit remains and repeat procedure. Polysulfides are formed by boiling sulfur in an alkaline or alkaline sulfide solution.

5. a. Sodium sulfide	28 oz./gal.
Sulfur	2 "
b. Sodium hydroxide	13 "
Sulfur	20 "
Temperature	185-205°F.

COPPER FROM STEEL:

6. Anodic cyanide treatment as Method 1, but add Rochelle salts (3 oz./gal.) and warm to reduce polarization.

7. Chromic acid	4 lbs./gal.
Sulfuric acid	4 fl. oz./gal.

8. Same as method 5.

COPPER, ZINC AND SILVER FROM ALUMINUM:

Aluminum is passive in nitric acid so that metals can be stripped in:

9. Concentrated nitric acid or one vol. conc. nitric acid to one vol. water.

CHROMIUM FROM STEEL:

Thin deposits of chromium can be stripped from steel by anodic treatment in almost any alkaline solution such as an electrolytic cleaner. Industrial heavy deposits should be ground. It is not necessary to grind away completely; they can be ground clean, activated, and replated.

10. Sodium hydroxide	7 oz./gal.
Sodium carbonate	9 "
Anodic current	75 amp./ft.^{2}
11. Hydrochloric acid	5-20%
Temperature	70-140°F.

Strip by immersion but remove frequently to observe point of complete stripping with minimum attack on the steel.

12. Treat anodically in chromic acid plating bath.

CHROMIUM FROM NICKEL:

13. Same as methods 10 to 12.

CHROMIUM FROM COPPER OR BRASS:

14. Same as method 11, or almost any concentration of hydrochloric acid adjusted in time and temperature to the desired stripping rate. Sulfuric acid can also be used to strip chromium or chromium plus nickel.

CHROMIUM FROM ZINC OR CADMIUM:

15. Similar to method 10 but use sodium carbonate only, to minimize attack of the basis metal.

CHROMIUM FROM ALUMINUM:

16. Treat anodically in a chromium plating bath.

CHROMIUM-NICKEL-COPPER FROM STEEL OR ALUMINUM:

A thin chromium deposit or chromium plus the other metals can be stripped in an electropolishing bath:

17. Phosphoric acid	3 quarts/gal.
Triethanolamine	1 "
Temperature	150-200°F.
Anodic current	100 amp./ft.^{2}

GOLD FROM COPPER:

18. Strip anodically in an alkaline cyanide solution as method 1.

19. Strip anodically in 5% hydrochloric acid but watch for complete stripping.

20. Light deposits can be stripped by immersion in:

Sodium cyanide	2 oz.
Water	1 pint
Hydrogen peroxide	½ fl. oz.

Strip a few pieces at a time under exhaust and in sink. Action will be violent and solution life will be short but can be regenerated to some extent by further additions of chemicals.

GOLD FROM NICKEL AND STEEL:

21. Same as method 20, but heavier deposits can be stripped from nickel and steel.

GOLD FROM ZINC AND COPPER:

22. Make work the anode in concentrated sulfuric acid. Temperature must be below 100°F. Add small amount of chromic acid or single nickel salts to help the action. The method can be used to strip heavy deposits.

LEAD FROM COPPER:

23.

Glacial acetic acid	1 gal.
Water	3 "
30% hydrogen peroxide	20 fl. oz.

LEAD FROM SILVER:

24.

Glacial acetic acid	19 fl. oz.
30% hydrogen peroxide	1 "

LEAD FROM STEEL:

25. Treat anodically in 5% sodium hydroxide solution at 2 to 4 volts. Heat and add Rochelle salt to increase stripping rate.

26. Neutralize a 1-1 solution of ammonium hydroxide with 80% acetic acid and add 2 ml. in excess for every 100 ml. of solution. Immerse at 130-140°F.

27.

Sodium nitrate	67 oz./gal.
pH	6-10
Temperature	70-180°F.

Treat anodically at 20-200 amp./ft.²

NICKEL FROM STEEL:

Nickel is difficult to strip from steel because of similar chemical activity of these metals and because the nickel tends to passivate. It is often better to remove nickel by mechanical means. However, with a little experience, the nickel stripping methods can be applied.

28.

Concentrated nitric acid or preferably fuming nitric acid	1 gal.
Hydrochloric acnd	0.1 fl. oz.

Put work in dry. Keep covered when not in use and keep out water.

29.

Sulfuric acid	3 gal.
Water	2 "
Room temperature	
Anodic (lead cathodes)	6 volts

30.

Sodium nitrate	4-5 lb./gal.
Temperature	200°F.
Anodic (100 amp./ft.² (min.)	6 volts

31.

Chromic acid	2 lb./gal.
Boric acid	3 oz./gal.
Temperature	155-185°F.
Anodic	150-250 amp./ft.²

NICKEL FROM COPPER OR BRASS:

32. Strip with sulfuric acid as method 29.

33. Strip anodically in hydrochloric acid 2 oz./gal. and watch for complete stripping.

34. Light deposits of nickel may be removed in a sulfuric-nitric bright dip.

NICKEL FROM MAGNESIUM:

35. Strip anodically in 15-25% hydrofluoric acid and 2% sodium nitrate.

NICKEL FROM ALUMINUM:

36. Strip anodically in concentrated sulfuric acid.

NICKEL FROM ZINC:

37. Strip as in method 36, or in 50-50% sulfuric acid at 150°F. and 9 volts.

ANODIZED COATINGS FROM ALUMINUM:

38. Oxide coatings can be stripped quantitatively from aluminum in chromic-phosphoric acid solutions:

Phosphoric acid	40-100 ml./l.
Chromic acid	20-40 g./l.
Temperature	160-210°F.

39. Nitric-hydrofluoric acid solutions will strip the oxide coating and etch the aluminum:

Nitric acid	3 gal.
Hydrofluoric acid	1 gal.

More dilute solutions can be used hot. Smut that is formed is removed by immersion in 1-1 nitric acid.

ANODIZED COATINGS FROM MAGNESIUM:

40.

Chromic acid	24 oz./gal.
Temperature	120-160°F.

BLACK OXIDE COATINGS FROM STEEL:

41. Immerse in 1-1 inhibited hydrochloric acid or inhibited hydrochloric acid pickling bath.

PHOSPHATE COATINGS FROM STEEL:

42. Zinc-type coatings are stripped in concentrated ammonium hydroxide.

43. Manganese-type coatings are stripped in 20% chromic acid at 165°F.

PLATINUM FROM STEEL AND NICKEL:

44. Thin deposits can be stripped in nitric-hydrochloric acid but the solution decomposes readily.

Hydrochloric acid	1 qt./gal.
Nitric acid	2 "

45. Platinum can be salvaged by dissolving away the basis metal in a mineral acid.

RHODIUM:

46. Rhodium can be removed in flakes by dissolv-

ing the basis metal as with platinum and method 45.

47. Rhodium has been stripped electrolytically with some success (the electrolytic action dissolves a nickel undercoat):

a. Sulfuric acid	55-56° Baumé
Temperature	90-100°F.
Anodic	7 volts

Water should be kept out of bath and parts rinsed in bath before applying current.

b. Hydrochloric acid	5% by vol.
Temperature	room
Anodic (agitate work)	6 volts

SILVER FROM STEEL:

48. The most satisfactory method of stripping silver from steel is by anodic dissolution in 5% NaCN at 2 volts.

49. Sodium cyanide	8 oz./gal.
Hydrogen peroxide 30%	1 "

Use exhaust ventilation and add hydrogen peroxide periodically.

SILVER FROM BRASS OR NICKEL SILVER:

50. Sulfuric acid	19 volumes
Nitric acid	1 volume
Temperature	180°F.

Keep water from entering bath.

SILVER FROM WHITE METAL:

51. Strip anodically in cyanide as method 48.

TIN FROM STEEL:

52. Strip anodically in alkaline-Rochelle bath as method 25.

53. Strip by immersion in hydrochloric-antimony solution as method 3.

TIN FROM COPPER, BRASS OR BRONZE:

54. Methods 3 and 25.

55. Strip in concentrated cold hydrochloric acid or hot dilute hydrochloric acid. Or, strip anodically in hydrochloric acid but watch for complete stripping.

56. Ferric chloride	10-14 oz./gal.
Copper sulfate	18-21 "
Acetic acid (56%)	40-60 fl. oz./gal

Reactivate bath by additions of hydrogen peroxide.

TIN-ZINC ALLOY FROM STEEL:

57. Sodium hydroxide	14 oz./gal.
Sodium chlorite	3 "

Use near boiling. (Take care in the use of sodium chlorite as advised on shipping label of container.)

TIN ALLOYS:

58. Try methods for stripping of tin.

ZINC FROM STEEL AND COPPER:

59. Warm dilute hydrochloric or sulfuric acid.

60. Ammonium nitrate ——— 10-15%

61. Hot sodium hydroxide solution.

62. Same methods as for stripping cadmium.

References

1. Metal Finishing Guidebook, p. 483, 1958 Ed.
2. Plating, **35**, 1013 (1948).
3. Blum and Hogaboom, "Principles of Electroplating and Electroforming," p. 427, Third Ed., 1949, McGraw-Hill Co., N. Y.
4. Ollard and Smith, "Handbook of Industrial Electroplating," p. 251, Second Ed., 1954, Illife & Sons Ltd., Lndon.

FINISHING ZINC BASE DIE CASTINGS

(*Continued from page* 59)

used due to the ability to control the texture of the finish and the ability to mask minor defects. These types of coatings, which would also include the hammered, crackled, and veined finishes, are resistant to chemical attack, especially from solvents such as kerosene, gasoline and alcohol, and have good adhesion and wearing qualities. As with the enamel type finishes, chemical pretreatment will be dependent upon the anticipated service conditions, whereas, the use of a primer is optional. In the latter instance, if a primer is employed, a neutral wrinkle primer is employed in conjunction with light colored wrinkle enamels. The low temperature required for baking, which is at 250°F. for about 1 hour, is especially attractive for zinc die castings. In addition, a metallic effect is possible.

Water reducible coatings, that are available in a range of colors and glosses, are reputed[12] to have good adhesion on zinc die castings without the use of a pretreatment. These coatings have the advantage in that both fire and health hazards are reduced, which are present when organic solvents are used.

References

1. ASTM Designation B252-51T, "Tentative Recommended Practice for Preparation of Zinc Base Die Castings for Electroplating."
2. Stephenson, W. G., "Heat Treatment Improves Plating on Zinc Die Castings," Products Finishing (Jan. 1956).
3. Frederic B. Stevens Inc., Technical Bulletin No. P-125, "Finishing of Zinc and Aluminum Base Die Castings."
4. Horvick, E. W., "Automatic Plating of Zinc Die Castings," Metal Finishing, **55**, No. 1 (Jan. 1957).
5. Tuttle, K., "Nickel Plating Solutions and Processes," U. S. Pat. 2,069,566 (Feb. 2, 1937).
6. Pinner, W., Soderberg, G. and Baker, E., Trans. Electrochem. Soc., **80**, 550 (1941).
7. E. I. Du Pont de Nemours & Co., Inc., Products Bulletin SP 10 1149, "Cleaning Zinc Base Die Castings for Copper Plating."
8. Horvick, E. W., "Preparing and Painting Zinc Surfaces," Products Finishing (Feb. 1956).
9. Faulke, D. G., "Periodic Reverse Current Plating on Die Castings," Die Castings (Aug. 1949).
10. Ostrow, B. D. and Nobel, F. I., "Cyanide Copper Plating," Metal Finishing Guidebook, 1956 Ed., pp. 276-286, Finishing Publications, Inc., Westwood, N. J.
11. Pocock, W. E., "Chromate Coatings," Metal Finishing Guidebook, 1956 Ed., pp. 464-476, Finishing Publications, Inc., Westwood, N. J.
12. "A Working Guide to Organic Coating of Die Casting," Precision Metal Molding (Mar. 1956).
13. McFarlane, T. P., "New Chrome Finish Cuts Part Handling and Cleaning," Iron Age (Dec. 1, 1955).
14. "A Working Guide to Selecting and Applying Surface Protection for Die Castings," Precision Metal Molding (Dec. 1955).

Iron Analysis in Chromium Solutions

By A. Salka, *Chief Laboratory Engineer, Nymanbolagen AB, Uppsala, Sweden*

IN a chromium plating bath metallic impurities such as iron decrease the conductivity of the solution and the current density range for bright deposits; the solution also becomes more sensitive to variations in catalyst acid radical concentration. The upper limit of iron content permissible is about 15-20 g./l.

The method generally used for iron determination has been described by K. E. Langford (Analysis of Electroplating and Related Solutions: 1951). This method is based on ammonium hydroxide precipitation of hydroxides and chromates of metals having such insoluble compounds. The chromium chromate is oxidized by hydrogen peroxide to the hexavalent state, while reprecipitations eliminate all metals whose hydroxides are soluble in excess ammonia; thus, only iron and aluminum remain and are generally reported together. The method is not a rapid one since the reprecipitations are rather time-consuming.

In the procedure outlined below, the iron is sepa-

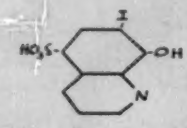


Fig. 1

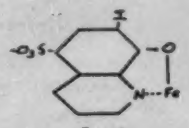


Fig. 2

rated as ferric phosphate and determined by complexometric EDTA titration with 8-hydroxyquinoline-7-iodo-5-sulfonic acid (ferron) as indicator (See Fig. 1). Acid solutions of trivalent iron react with ferron, producing a green color due to the formation of the inner complex anion. (See Fig. 2).

The EDTA/iron complex shows a greater stability constant than the ferron/iron complex; therefore, when all the iron has been transferred into the EDTA/iron complex, the endpoint is marked by a sudden color change from the green of the ferron/iron complex to the yellow of the free indicator.

The method has the advantage that only iron is determined since the reagent is specific. The only interference arises from the presence of trivalent chromium. The simplest method to avoid the interference is to oxidize the sample in acid solution with ammonium persulphate.

Reagents

a) EDTA solution, 0.100 molar. Dissolve 37.23 g. disodium dihydrogen ethylenediaminetetraacetate dihydrate and dilute to exactly one liter with water.
b) Saturated ferron indicator solution.
c) Sulphuric acid 1:1.
d) Phosphoric acid (conc.).

Procedure

Take a sample of the bath containing about 50 mg iron. Dilute to 100 ml in a 250 ml beaker and add 2 ml conc. phosphoric acid. If trivalent chromium is present heat to boiling and add 4 g ammonium persulphate and continue heating until all the excess oxygen is driven off (approx. 10 minutes). Cool and check the pH, which must be between 3.3 and 3.5. If necessary adjust. After the pH adjustment heat to boiling and filter the hot solution. Wash the filter paper until no trace of yellow color is left and dissolve the precipitate with hot mixture of 5 ml sulphuric acid 1:1 + 50 ml distilled water. Wash the filter paper with 100 ml water and adjust the pH to 1.5 (the solution must be clear after the adjustment).

Table 1

mg iron added	*mg iron found*
50	50.1
40	40.0
30	30.05
20	20.09

Finally, add 1 ml of the saturated ferron indicator solution, warm to about 30-35°C. and titrate with 0.100-molar EDTA solution until the green color fades, then raise the pH to 2.0-3.0 with 1-molar ammonium hydroxide and continue the titration until the green color changes to yellow.
1 ml of 0.100 molar EDTA solution is equivalent to 5.585 mg iron.

Discussion

The method outlined above gives very sharp endpoints and the accuracy and precision fall within the limit of 1 drop of titrant. Since the time involved for most samples is less than 20 minutes, the procedure is truly described as a rapid one.

Typical results obtained with the above procedures are given in table 1, using 3 ml of a solution containing 400 g/l chromic acid.

FINISHING POINTERS

Technical Control Data

ANALYTICAL chemistry is an exact science. The accuracy of the analysis of silver in a coin at the U. S. Mint, as an example, is extremely precise. The analyst knows the accuracy required and selects methods to stay within the allowable range of error. The plating control chemist knows that his allowable error is large and, therefore, develops rapid, practical methods rather than tedious accurate analyses.

Take a good look at the average plating bath. The solution level is about 30 inches and, if the level is held within $\pm\frac{1}{2}$ inch, solution level control is satisfactory. This is a total variation of over 3%. Why then should one bother with common analytical accuracy of 0.1% when the bath itself normally varies by 30 times this amount? If the bath is hot the variation will be even greater. Consider too that a bath at 180°F. will contract about 3% on cooling to 70°F. Volume errors in sampling can be appreciable unless samples are taken at the same temperature and bath level.

Experimentation will show that most plating baths will show very small changes in characteristics if they are diluted 10%. Therefore, as a general rule, a total error of 10% in sampling, analyses, and adjustment is allowable. Certainly an error of 5% is allowable in the analytical method. Due to this large allowance, it is practical to utilize approximate methods. In the case of impurities such as carbonate build-up in an alkaline bath, larger errors are not harmful.

One should assume a large allowable error when establishing control methods; however, caution should be exercised that unduly large errors are not introduced. Free cyanide in a cyanide copper bath can be determined by a rapid titration, but the specified range should be held; in fact, special precautions must be taken when free cyanide is determined in a high efficiency copper cyanide bath. Nickel baths also should be held within reasonably close limits since the characteristics of nickel baths can change markedly with changes in bath composition. An analytical error of 5% is a good general allowance. Experience will tell whether a greater or lesser error is more practical.

Published control procedures include modifications of accurate analytical methods, and errors in general are small. A method that is widely recommended will be sufficiently accurate to satisfy all applications of the bath. With the specific application, such as a thin "flash" deposit, liberties can be taken. However, this should be done to apply to the individual application rather than the general bath.

When a method is applied to a specific operating bath, one may deviate from standard practice in keeping with the demands on the quality of the deposit. If this is done to take advantage of approximate methods, then the method becomes technical and the classical evaluation of analytical errors need not be considered.

Analyses become rapid when one resorts to measurements of specific gravity, pH, and conductivity. The approach is technical and, since errors are large, one need not be concerned with lengthy standardizations. The formula of a chemical can be assumed from the label on an analytical grade reagent bottle without resorting to analyses. Sulfuric acid, as an example, is 96% H_2SO_4 specific gravity 1.84 or 1.77 g./ml. H_2SO_4. $Al_2(SO_4)_3 \cdot 18H_2O$ is 8.1% Al by calculation rather than by analysis.

Let us take an example:

Data were taken, as shown in the table, as a basis

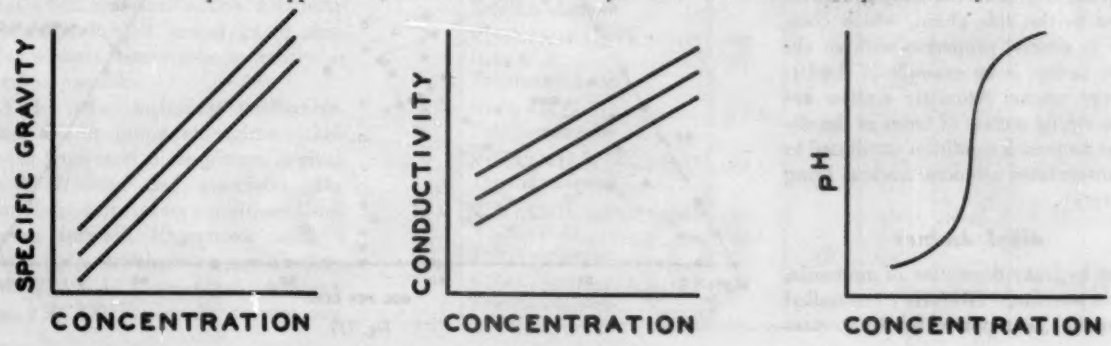
Specific Gravity of Sulfuric Acid — Aluminum Sulfate Solutions*

H_2SO_4 g./l.	Al g./l.	°F.	Specific Gravity meas.	Specific Gravity calc.**
0	9.7	70	1.061	1.055
174	0.0	70	1.104	1.104
87	4.9	70	1.082	1.080
175	4.9	70	1.131	1.133
175	9.7	70	1.159	1.160
175	4.9	106	1.120	1.122
175	9.7	116	1.149	1.146

*See Finishing Pointer on "Specific Gravity of Sulfuric Acid—Aluminum Sulfate Solutions."

**Specific Gravity = 1.000 + 0.00060A + 0.0057B + 0.0003 (70-T) where: A = g./l. H_2SO_4, B = g./l. Al, T = Temp., °F.

of suggesting specific gravity as an over-all check on a sulfuric acid anodizing bath. The data are limited and the procedure is technical. The total time spent in taking and analyzing the data was only a matter of hours, hardly a precise control procedure. Yet these data may be very useful and sufficiently accurate to save many hours of trouble. The point is that data of this type can be taken in no more time than is often spent on a single precise analysis. This certainly should be done when a few hours time will assure practical methods that can be applied on the processing line. Better control will result from frequent practical analyses than from occasional precise analyses.



Science for Electroplaters

42. AMINES

By L. Serota

AMINES are classified as derivatives of ammonia, NH_3, in which one or more of the hydrogen atoms may be replaced or substituted by an aliphatic (alkyl) or aromatic (aryl) radical. When one of the hydrogen atoms in ammonia is replaced, giving the general formula $R.NH_2$, the NH_2 group is known as the amino group. For the aliphatic amines, methylamine (amino methane) would be represented by the formula CH_3NH_2, and the formula for n-propylamine (n-aminopropane) would be $CH_3CH_2CH_2NH_2$.

Aliphatic amines are stronger bases than solutions of ammonia, and form salts with strong acids such as methylamine hydrochloride, CH_3NH_2HCl (or substituted ammonium salt, methylammonium chloride, CH_3NH_3Cl).

Aromatic amines are divided into two groups, namely, those in which the NH_2 (amino) group is attached or linked to the nuclear carbon, and those in which it is attached to a carbon of the side chain. Aniline (aminobenzene or phenylamine), $C_6H_5NH_2$, is an example of the former. Benzylamine, $C_6H_5CH_2NH_2$, with the NH_2 group attached to the side chain, which compares in general properties with an aliphatic amine, is an example of the latter type amine. Aromatic amines are not as strong a class of bases as the eliphatic amines, a condition attributed to the unsaturated aromatic nucleus (ring structure).

Alkyl Amines

The hydroxy derivative of ammonia, hydroxylamine, $HO{\cdot}NH_2$ (monalkyl derivative), is reported by *W. D. Bancroft* as an addition agent to a copper sulfate solution. Its addition permits the use of higher current densities.

The electrodeposition of aluminum from an organic solution in which aluminum chloride is dissolved in a mixture of n-butyl amine, $CH_3(CH_2)_3NH_2$ or $C_4H_9NH_2$, and diethyl ether, $(C_2H_5)_2O$, was reported by *N. F. Nelson* and associates. The aluminum salt could not be dissolved separately in either solvent, a condition attributed to the reaction in which the amine coordinates with the aluminum chloride. To prepare the mixture satisfactorily, the aluminum chloride was dissolved in ether and added to a solution of the amine dissolved in ether. Slow addition, while mixing, obviated a cooling process. The most favorable operating conditions include a closed cell with reflux condenser attached, to avoid loss by evaporation of the volatile solvent. Cooling coils in the bath are desirable for temperature control.

A wide range of operating temperature is indicated since, with higher temperatures, the solution is less viscous and exhibits greater conductivity, a factor favorable for smoother and brighter deposits. The mixture or solutions of the aluminum chloride-amine ether, which consist of a single phase (free of solids) and provide a good deposit, are included in the dotted area in the ternary diagram of the three-component system (Fig. 179). Any point (solid black circles) within the boundary indicates such a three-component system investigated. Suspended solids (in the outer area) are mixtures which produce poor deposits.

Anode current efficiency is almost theoretical, whereas, cathode efficiency is only 50 to 65 percent. This results in an increase in the aluminum concentration in the bath mixture, thereby bring-

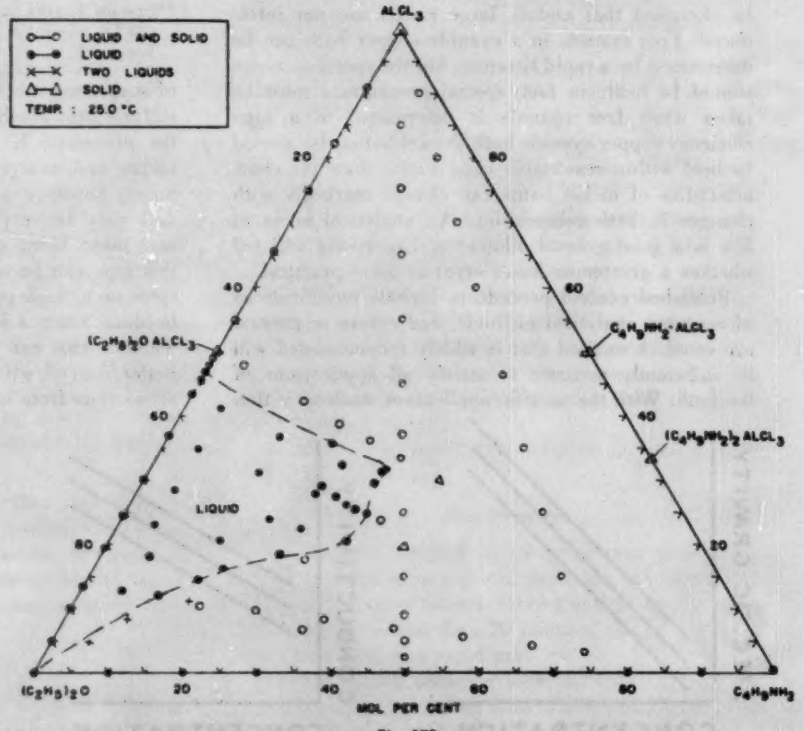


Fig. 179.

TABLE I.

Comparison of Copper Strike Baths.

Per cent Cathode Current Efficiencies.

Time in seconds	A. Oxalate		Cyanide		D. Tartrate 2.6 amp./dm.²	B. Triethanolamine-boric 3.2 amp./dm.²	C. Triethanolamine-oxalate 0.4 amp./dm.²
	3.2 amp./dm.²	1.1 amp./dm.²	3.2 amp./dm.²	1.1 amp./dm.²			
10	29	72	7.5	17	106	64	115
30	26	43	22	22	88	103	97
50	..	64	21	19	91	108	110
70	21	64	22	26	..	105	97
90	19	54	22	28	90	99	90
120	20	52	24	30	72	94	89

ing the composition in the diagram beyond the dotted line area. Composition controls (removal of excess aluminum compounds) is attained by crystallization or evaporation, and removal of anodes when the bath is not in use. A zinc flash was found to provide better adhesion of the aluminum deposits to steel cathodes. Periodic reverse direct current improved the brightness of the deposit on steel cathodes, but not on copper cathodes.

A study of current density was made, using a Hull cell, with a mixture consisting of 25.6 mol percent aluminum chloride ($AlCl_3$); 15.2 percent 2-ethyl hexylamine ($C_8H_{17}NH_2$); and 59.2 mol percent diethyl ether [$(C_2H_5)_2O$]. A brighter deposit at a range of 2 to 12 amp./dm.² was obtained.

Ethanolamines

Ethanolamines, alcoholic amines or hydroxylalkyamines, are prepared by treating ethylene oxide with ammonia. The reaction will produce a mixture of (mono) ethanolamine, $HOCH_2CH_2NH_2$, diethanolamine, $(HOCH_2CH_2)_2NH$, and triethanolamine, $(HOCH_2CH_2)_3N$. Separation of the ethanolamines is effected by fractional distillation. Triethanolamine will form largely when the ammonia is in excess in the ratio of 3 mols of ammonia to 1 mol of ethylene oxide. Ethanolamines possess both basic and acid properties since salts form when acids are added. Ethanolamines also exhibit properties of alcohols, wherein conversion to ethers or esters is possible.

A formula, including triethanolamine, for stripping chromium-nickel-copper from steel or aluminum, is given by *N. Holland* and associates. The formula and operating conditions listed are as follows: Phosphoric acid, 3 quarts/gal.; triethanolamine (boiling point 277°C.), 1 quart/gal.; temperature, 150°200°F.; anodic current density 100 amp./ft.² The formula is recommended for removing a thin chromium deposit or, with a longer treatment period, stripping other metals.

A cleaning process for ferrous metals, suggested by *C. B. F. Young*, includes the following procedure:

1. Chlorinated solvent degreasing; 2. Emulsifying solvent; triethanolamine tallate, 15%; butyl carbitol, 10%; cresylic acid, 10%; kerosene or mineral spirits, 65%. This mixture is to be used at room temperature. The work may be soaked or sprayed, then rinsed with spray rinse.

A continuous method has recently been patented for producing copper coatings on silver mirrors, by the silver salt-reducing agent procedure for depositing silver followed, while still wet, by a spray of a copper sulfate solution. (.1-.2% copper sulfate, pH 0.8-1.2) and a 2-4 percent suspension of copper-coated, finely divided iron particles (.1-.005 mm), including about 0.0002 percent hydrazine, 0.001 percent formaldehyde and 0.001 percent triethanolamine.

A modification of the practice of adding ammonia or ammonium salts to brass baths for the purpose of improving the color of the deposit, especially in decorative processes, is that reported by *L. E. Weig* and *H. J. Wiesner*. Reference is made by the authors to a British patent process in which monoethanolamine, $HOCH_2CH_2NH_2$, is substituted satisfactorily for ammonia. The low volatility of this amine permits operation of the bath at higher temperatures. A concentration of 1.3 oz./gal. was required to give results similar to that obtained with 0.13 oz./gal. of ammonia.

T. J. Ramachar and *N. B. Shivaraman* describe a method of electrodeposition of copper on steel from a complex copper monoethanolamine bath. The addition of monoethanolamine to

TABLE II.

Composition of Solutions and Results Obtained.

No.	Composition	Concentration g./L.	Concentration cc./L.	Concentration Molarity	Temp. Range °C.	Current Density amp./dm.²	Cathode Efficiency %
1	$NiSO_4(NH_4)_2SO_4.6H_2O$	83.3		0.21			
	Triethanolamine		121	0.86	13-30	3.4-41	19-38
2	$NiSO_4(NH_4)_2SO_4.6H_2O$	83.3		0.21	13-30	7-17	40-56
	$NiSO_4.6H_2O$	41.6		0.15			
	Triethanolamine		166	1.2			
3	$NiSO_4.6H_2O$	75		0.27	14-30	7-14	70
	Triethanolamine		100	0.71			
4	$NiSO_4(NH_4)_2SO_4.6H_2O$	84.2		0.22	16-28	5-18	31-60
	Triethanolamine		155	1.1			
5	$NiCl_2.6H_2O$	112		0.46	14-30	4-20	16-40
	Triethanolamine		56	0.4			
6	$NiSO_4(NH_4)_2SO_4.6H_2O$	50.4		0.13	16-30	5-12	30-41
	H_3BO_3	14		0.23			
	Triethanolamine		73	0.52			
7	$NiSO_4(NH_4)_2SO_4.6H_2O$	60		0.15	15-30	3-25	18-26
	H_3BO_3	11		0.18			
	Triethanolamine		100	0.71			
8	$NiCl_2.6H_2O$	73.3		0.31	16-30	3-18	37-52
	Triethanolamine		49	0.35			
9	$NiSO_4(NH_4)_2SO_4.6H_2O$	70		0.18	16-30	5-27	12-23
	Triethanolamine		100	0.71			
10	$NiSO_4(NH_4)_2SO_4.6H_2O$	24		0.06	18-22	7-13	.....
	$NiCl_2.6H_2O$	11.2		0.05			
	Triethanolamine		65	0.46			
11	$NiSO_4(NH_4)_2SO_4.6H_2O$	120		0.30	14-30	7-30	18-49
	Triethanolamine		200	1.42			

copper oxalate suspended in water will yield a clear blue solution, owing to the formation of a complex. When Rochelle salt was included in the bath formula, e.m.f. determinations indicated that the metal ion concentration was further reduced. For example, the addition of 60 g./l. Rochelle salt to a bath containing 60 g./l. of copper oxalate and 60 ml./l. of the amine resulted in a lowering of metal ion concentration from 1.90×10^{-11} to 3.16×10^{-13}N. At this low concentration, copper did not deposit on steel by chemical displacement. The addition of Rochelle salt also aided anode corrosion at high current densities; permitted lower bath voltage; increased the current density range, conductivity, and chroming power, and eliminated treeing. This bath, with the composition listed, gave smooth, fine-grained, and bright copper deposits on steel. The proportions cited were found to be optimum and gave the best results with the following operating conditions: current density 2.4-4.8 amp./dm.^{2}; pH 9.5; temperature 24°C. The cathode efficiency of the bath is 90-94 percent. This bath, however, does not operate satisfactorily at higher temperatures and has lower values than the cyanide bath in conductivity and throwing power.

A comprehensive study of strike copper plating from (alkaline) triethanolamine solutions was described by *C. J. Brockman*. Deposition of copper on iron or steel from this solution, unlike others, will not occur by displacement. A bright adherent copper plate is possible in 70 seconds at a current density of 3.6 amp./ft.^{2} This copper coating will take a satisfactory adherent copper plate from an acid copper sulfate bath.

When triethanolamine is added to a copper sulfate solution, a greenish white precipitate forms, which redissolves to a deep blue color when an excess of triethanolamine is added. Experimental results demonstrated that more triethanolamine is required per gram of copper sulfate to form the copper complex from dilute solutions. For example, a solution of 5 grams of copper sulfate crystals in 25 cc. water required 5.3 cc. triethanolamine to form a clear solution, whereas, a dilute solution consisting of 15 grams of copper sulfate crystals in a liter of solution required 25 to 26 cc. of triethanolamine. Current density and potentials required to produce bright copper on steel strips varied with reagent concentrations.

TABLE III.

Electroplating Copper from Solutions of $CuSO_4$ + Diethylenetriamine.

$CuSO_4 \cdot 5H_2O$ g./L.	Amine cc./L.	pH	Temp., °C.	Amp./sq. in.	Amp./dm.^{2}	Cathode Efficiency Per Cent
100	70	10.3	20	0.04	0.6	91
100	70	10.3	20	0.05	0.8	97
100	70	10.3	20	0.10	1.6	84
100	70	10.3	20	0.14	2.2	75
100	70	10.3	20	0.20	3.1	83
50	35	9.4	25	0.05	0.8	86
50	35	9.4	25	0.07	1.1	93
50	35	9.4	25	0.10	1.6	91
50	35	9.4	25	0.20	3.1	88
50	35	9.4	50	0.05	0.8	113
50	35	9.4	50	0.07	1.1	122
50	35	9.4	50	0.10	1.6	91
50	35	9.4	50	0.20	3.1	94
25	17.5	9.4	25	0.05	0.8	97
25	17.5	9.4	25	0.10	1.6	89
25	17.5	9.4	25	0.20	3.1	86
25	17.5	9.4	30	0.03	0.5	97
25	17.5	9.4	30	0.07	1.1	97
25	17.5	9.4	30	0.09	1.4	84
25	17.5	9.4	30	0.10	1.6	84
25	17.5	9.4	30	0.20	3.1	85

Two types of copper sulfate-triethanolamine strike baths were included in the study of plating on steel. Current efficiencies for this bath were compared with (1) a complex copper oxalate bath proposed by *C. Fink* and *H. Wong*, consisting of copper oxalate, 20 g./l.; sodium sulfate, 15 g./l.; boric acid, 20 g./l.; (2) a tartrate bath of the following composition: copper sulfate, 60 g./l.; sodium hydroxide, 50 g./l.; sodium potassium tartrate (Rochelle salt), 159 g./l.; (3) the standard cyanide bath. The data are recorded in Table 1. Boric acid was included in one of the strike baths to prevent copper plating by displacement, but results were not satisfactory. The composition of the bath containing boric acid included: copper sulfate crystals, 150 g./l.; boric acid, 30 g./l.; triethanolamine, 270 cc./l. An excess of triethanolamine was added to compensate for the neutralization of some triethanolamine by the boric acid. The second bath, bath C, which contained sodium oxalate, did not plate by contact. The composition given is: copper sulfate crystals, 15 g./l.; sodium oxalate, 10 g./l.; triethanolamine, 22 cc./l.

Current efficiency was determined on the basis of a valence of 2 for all baths except the cyanide copper bath, in which the valence of copper is taken as 1. Where the efficiency is greater than 100 percent the presence of cuprous copper is given as the reason. Bath C was found to give good bright copper deposits on steel and exhibited high current efficiency. A 70 second strike was required to permit a good undercoat for plating with the commercial copper bath. An advantage cited for this strike bath, in addition to the high current efficiency, is its non-poisonous nature. A greater weight of deposited copper was obtained from bath C than from bath A, for a given period. This latter bath exhibited the added disadvantage of plating copper by displacement. Bath D required a much higher current density than that recommended. A 90 second strike from this bath gave a satisfactory deposit (without peeling) from a commercial copper sulfate bath.

In an effort to overcome the difficulty of poor adhesion when nickel is deposited on zinc from a neutral or acid solution, owing to displacement, since zinc is more electronegative than nickel, *C. J. Brockman* and *J. P. Nowlen* investigated direct plating of nickel on zinc from an alkaline nickel bath containing triethanolamine. Excellent deposits were reported obtained on zinc, under experimental conditions, from various nickel solutions, as indicated in Table 2.

The nickel deposits were bright and showed good results when color buffed.

This effect, it is noted, was obtained even after a yellow tone developed on the nickel surface because of weeks of storage in the laboratory. The nickel chloride solutions numbered 5 and 8 in Table 2 were found difficult to operate and gave deposits which were more granular and difficult to buff than plates obtained from the mixed chloride-sulfate baths. The formula suggested for the methanolamine nickel complex is

$$(C_2H_4OH)_3N \diagdown \quad \diagup x$$
$$\qquad\qquad Ni^{++}$$
$$(C_2H_4OH)_3N \diagup \quad \diagdown x$$

The initial cathode potential, it is emphasized, must be greater than the static potential, which for zinc is —0.8 volt, to prevent streaked deposits, a condition that will be caused by zinc going into solution.

The effect of amines as addition agents in zinc electroplating solutions was studied and reported by *J. L. Bray* and *F. R. Morral*. Results led the authors to conclude that the amount of nitrogen in the amine will influence the appearance and ductility of the deposit. Results seemed to be the same for most amines tested. A quantity as little as 0.0006 g./l. of nitrogen in solution is sufficient, indicating catalytic effect. Careful rechecks with triethanolamine and trimethylamine with concentrations of .0006 g./l. or less of nitrogen are mentioned as giving good results.

Diethylene Triamine

A continuation of the study by *C. J. Brockman* of organic amines in alkaline plating solutions included the use of diethylene triamine, $H_2NC_2H_4NHC_2H_4NH_2$, in a copper sulfate electroplating solution. The formation of the complex copper compounds by such organic amines tends to reduce the concentration of free copper ions to the extent that displacement of copper when in contact with iron is avoided.

A sufficient amount of diethylene triamine is added to give a clear, deep blue solution. Excess reagent lowers the cathode efficiency. Bright, light colored, smooth, and firmly adherent electrodeposits were obtained under varying conditions. Additional diethylene triamine is added to the bath to redissolve the insoluble salt which may form. The deposit for a one hour plating period was found to be smooth and hard, did not peel or curl, and was difficult to remove with a wire brush wheel. Experimental results are indicated in Table 3.

At constant current density, 0.07 amp./in.^{2}, for the following bath composition: 50 g./l. $CuSO_4 \cdot 5H_2O$; 35 cc./l. diethylene triamine; pH 9.4, an increase in cathode efficiency resulted with increase in temperature. At 25°C., the current efficiency was 93%, at 40° C., 97% and, at 50°C., it was 122%. The greater than 100 percent cathode efficiency at 50°C. is attributed to the formation of cuprous ions caused by the greater reducing action of the amine at higher temperature.

During the discussion period following the presentation of this paper, *N. Hall* stressed the potential value of alkaline plating baths which will not decompose, as an advantage, when compared to the quite rapid decomposition produced, at higher operating temperature, of sodium cyanide in the copper cyanide bath.

The electrodeposition of uniformly bright copper over an entire surface from an amine bath, to which ammonium sulfate was added in addition to the diethylene triamine recommended by *J. C. Brockman*, was reported by *L. Greenspan*. The composition and operating conditions of the bath consisted of the following: copper sulfate crystals, 100 g./l.; ammonium sulfate, 20 g./l.; diethylene triamine, 80 cc./l.; C.D. 40 amp./ft.^{2}; temperature, 55°-60°C.; mild agitation.

The elimination of brittleness, a quality otherwise exhibited by copper deposited from the diethylene triamine bath, is ascribed to the presence of free ammonia resulting from the buffering action of ammonium sulfate. The addition of 3-5 cc. of concentrated ammonium hydroxide per liter per day was found sufficient to make up the loss from evaporation. The author notes that operation of this bath on a commercial scale in a Midwest plant has been proceeding satisfactorily for a year and a half. Pitting will be caused by the presence of small amounts of iron; hence, a rubber or plastic lining is advisable. A dull appearance is caused by certain organic impurities. The organic contaminants may be removed by carbon treatment and the iron impurity, which is present as the insoluble hydroxide at the bath pH of about 9, can be removed by filtration.

Tests indicated that other amines of the ethylene series, such as triethylene tetramine, tetramethylene pentamine, or others, may be substituted for diethylene triamine with quite satisfactory results. Ethylenediamine is not recommended because it is volatile.

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METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Coloring Bronze Plaques

Question: Please advise as to the proper method of applying a brown color on cast bronze plaques to be placed on the outside of buildings.

P. W. Z.

Answer: The brown color on bronze plaques is produced by first thoroughly cleaning the part, then immersing at room temperature in a solution of ¼ oz./gal. liver of sulfur or one of the proprietary polysulfide solutions sold by most plating supply firms as "Oxidizing Liquid", or under a brand name.

When the required shade is reached, the parts are rinsed and wet scratch-brushed with pumice to bring up the bronze highlights, or are dried and buffed. For protection, a coating of lacquer or wax is then applied.

Gold Finishing Lead Alloy

Question: I have the following two questions which I would be grateful for information concerning:

We cast miniature items in short runs of a lead-tin-antimony alloy. 1. We want to find a method of cleaning, then coating with bright gold using an immersion series of operations or at least limiting our plating to one process. 2. We want to obtain particulars of a tumbling barrel, compounds and abrasives and media to produce a mirror finish for plating.

F. G.

Answer: The usual practice in finishing lead alloys is to bright nickel plate first, followed by a gold flash. We know of only one company which offers an immersion gold process, claimed to be suitable for lead alloys directly. It is suggested that you check with them or, possibly, have samples plated in their laboratory. Their address is enclosed.

On pages 618 and 619 of the 1958 edition of the METAL FINISHING GUIDEBOOK you will find a list of suppliers of barrel finishing equipment and supplies. These suppliers are prepared to process samples and suggest the most effective methods and equipment for finishing your parts.

Alkaline Rhodium Baths

Question: We know that rhodium is usually plated from a sulfate or phosphate acid type bath, also that platinum and palladium are plated from amino-nitrite baths.

Do you have any information about rhodium being plated successfully from an amino-nitrite type bath? If so, can one purchase rhodium amino-nitrite either as a concentrate or as a salt? Is there any other neutral or alkaline solution from which rhodium has been plated successfully?

K. R.

Answer: Rhodium can be plated from the same type of amino-nitrite baths as platinum and palladium. As a matter of fact, the first patents on the amino-nitrite baths covered all three metals. Details will be found in U. S. Patents 1,779,436-7 (Oct. 28, 1930), and you can check on availability of the salt with rhodium suppliers.

The only other alkaline rhodium bath of which we have any record employed the aminocyanide, and was patented by Wise (U. S. #1,991,995. Feb. 19, 1935). This bath was also claimed suitable for platinum and palladium, as well as rhodium.

We are unaware of any commercial applications of these alkaline baths. However, the patents give methods for preparing the rhodium salt and plating solutions, if it is desired to try them.

Cadmium Plating

Question: We have been using a dilute nitric acid bright dip on our cadmium plate line for about six months. This, according to the METAL FINISHING GUIDEBOOK (page 306) is not recommended. Why not? Does it have some delayed detrimental effect, or is the author concerned about the plate being stripped in the bright dip operation?

Also, our plating supervisor wants to use hydrated lime when hydroxide additions are required, and filter off the calcium carbonate to keep the carbonate content down. Is this permissible in a cadmium cyanide bath?

M. Y.

Answer: Nitric acid is not recommended for general use for two reasons. One is the production of streaked dark finishes if the plating solution contains small amounts of contaminating metals, and the other is its inability to form a lasting protective film. The chromate type dips are not subject to either of these limitations, and are employed universally.

Hydrated lime is a crude product which may contain sufficient impurities to contaminate the plating solution, when added in sufficient quantities to precipitate calcium carbonate. A purified grade of calcium hydroxide would be suitable, keeping in mind the resultant increase in caustic content, or materials such as barium cyanide and pure finely ground gypsum (calcium sulfate) may be used for the purpose.

Cathode Sputtering

Question: We are interested in the process known as sputter plating or sputtering. We would appreciate it if you would tell us where we could get information on the process, on the coating produced, and on the manufacturers of the equipment used.

W. B. H.

Answer: The process is referred to as "cathode sputtering" and is similar to vacuum metalizing, except that the part to be coated is placed between an

anode and a cathode in the vacuum chamber and a voltage is impressed between the electrodes to cause migration of the coating metal in a straight line.

Small units are available from some of the larger laboratory supply firms. We know of no suppliers for large capacity equipment for this process.

Cyanide Analysis in Wastes

Question: Please send to my attention, if possible, a copy of the article, "Science for Electroplaters: 33. Cyanide Waste Treatment — Ozonation and Electrolysis," by L. Serota, pp. 72-74, in METAL FINISHING, February, 1958.

Of particular interest were the analytical tests referred to: (1) Cyanide determination by the modified Liebig titrimetric method (with potassium iodide and p-dimethylamine-benzalrhodamine as indicators) and (2) Cyanate determination by the Nessler tube method. If you happen to have a write-up of these tests or can refer me to a source for them, I would appreciate it.

J. S.

Answer: We are forwarding tear sheets requested. Details on the analytical procedures will be found in A.E.S. Research Report, Serial No. 19, obtainable at $0.65 per copy from the American Electroplaters' Society, 445 Broad St., Newark 2, N. J.

Plating on Beryllium-Copper

Question: We have had difficulty in plating bright silver on beryllium copper; the part in question is folded later and the silver peels.

The copper pieces are cleaned in trisodium phosphate, pickled in HCl, and dipped in potassium cyanide; sometimes a strike is used and sometimes not — there seems to be little difference — before the silver plate.

Any comments you may have on this problem will be very much appreciated.

H. E. Z.

Answer: After cleaning, the parts should be pickeled in dichromate-sulfuric solution (4 oz./gal. sodium dichromate and ½ pint/gal. sulfuric acid). After the scale has been removed, the parts are rinsed and given a quick dip in 30% by volume nitric acid or a bright dip, rinsed and plated, preferably with a nickel deposit prior to silver.

Plating on Aluminum

Question: I was reading some of your articles in the GUIDEBOOK on aluminum finishing, and have a few problems that I would like some help on in the plating of aluminum.

In the zincate bath, would you recommend continuous stirring, and also, has current ever been used in the zincate bath using the tank for anode and the work cathodic. If so, what current is used per square foot?

R. A.

Answer: Stirring is not necessary in the zincate bath. However, the parts should be agitated while immersed to obtain a uniform coating.

In plating on aluminum, current has been employed in both zincate and in cyanide zinc baths. The current density will depend on the particular solution used, but will be about 10-25 amp./sq. ft. There has been very little definite evidence that the adhesion is improved by use of current, although some reports of good results have been issued.

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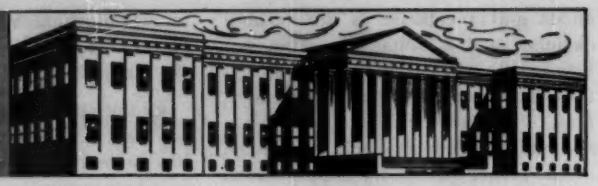
Patents

RECENTLY GRANTED PATENTS IN THE METAL FINISHING FIELD



Fixture for Metal Coating

U. S. Patent 2,829,621. *April* 8, 1958. *W. A. Billinghurst.*

A fixture for supporting a plurality of articles subject to application of coating material thereto comprising a hub structure and a plurality of equispaced resilient article supporting arms extending radially from the hub structure.

Vapor Phase Corrosion Inhibitor

U. S. Patent 2,829,945. *April* 8, 1958. *A. Krieg, assignor to The Cromwell Paper Co.*

A composition of matter particularly adapted for use as a vapor-phase corrosion inhibitor consisting essentially of 8 to 15 weight percent of dicyclohexylamine caprylate, 1 to 2 weight percent of morpholine caprylate, and the remainder being refined paraffin oil.

Electroplating Apparatus

U. S. Patent 2,830,946. *April* 15, 1958. *W. B. Pleadwell, assignor to Olive B. Pleadwell.*

In an electroplating apparatus, including a tank for containing an electrolyte, a work basket in said tank for the articles to be plated and pivoted to swing relatively to said tank, about an axis extending lengthwise of said basket approximately midway between the sides thereof, said basket having a bottom formed of two perforate panels extending lengthwise of the same and arranged at a re-entrant angle to each other, the sides of said basket being spaced at a greater distance from said axis than the distance between said axis and said bottom, mechanism for oscillating said work basket about its axis through an arc located mainly below said axis, and an anode arranged above said basket and mounted to swing about a substantially horizontal axis extending substantially parallel to the axis of said work basket, mechanism mounted on said tank for swinging said anode in an arc about another substantially horizontal axis arranged mainly above said axis of said anode.

Brighteners for Copper, Zinc and Nickel

U. S. Patent 2,830,014. *April* 8, 1958. *W. Gündel, W. Strauss and H. Haas, assignors to Dehydag, Deutsche Hydrierwerke G. m. b. H.*

An electroplating bath for producing electro-deposits of a metal selected from the group consisting of copper, zinc and nickel, comprising an acid solution of at least one inorganic salt of the metal to be electrodeposited and from 0.01 to 20 gm./liter of a sulfonic acid compound having a structural formula selected from the group consisting of

$$R—S—R_1—SO_3H$$

and

$$R—Y—S—R_1—SO_3H$$

and their alkali metal salts, wherein R is selected from the group consisting of hydrogen, acylic hydrocarbon radicals and cyclic non-heterocyclic hydrocarbon radicals, R_1 is a lower alkylene radical, and Y is selected from the group consisting of lower alkylene, —CSNH—, —CSNH-phenyl—, —CO—, —CS— and $—SO_2—$.

Abrasive Blasting

U. S. Patent 2,830,408. *April* 15, 1958. *H. Hastrup and R. C. Hastrup.*

In an abrasive blast cleaning machine, an operating head provided with a channel through which a blast stream is directed toward a work surface and a separate channel through which a suction stream draws spent abrasive away from said surface, said operating head being provided with a surface contactor for contacing said working surface to encircle and confine an area of said surface being cleaned.

Testing Aluminum Deposits

U. S. Patent 2,830,881. *April* 15, 1958. *H. J. Wittrock, assignor to Kaiser Aluminum & Chemical Corp.*

A method of determining the uniformity and thickness of aluminum and aluminum alloy coatings on ferrous metal which comprises subjecting the coated metal to a plurality of immersions of substantially the same period of time in an aqueous acid bath containing hydrogen ions and hydrogen potentially available for ionization and dissociation in amount from about 0.2 to 0.9% by weight of solution, copper ions and copper potentially available for ionization and dissociation in amount at least about 0.35% by weight of solution, and fluoride ions and fluorine potentially available for ionization and dissociation in amount from about 5 to 18.2% by weight of solution, said solution having a pH not in excess of about 2, said bath dissolving the coating metal at a predetermined rate per immersion period and providing a loosely adherent deposit of copper on the coating metal and a firmly adherent deposit of copper on exposed ferrous metal, rinsing said coated metal after each immersion to stop the dissolution action by said bath and removing loosely adherent copper deposit formed during each immersion, and continuing said cycle of operations until a firmly adherent copper deposit is provided on said ferrous metal, the uniformity of said coating being determined by the presence simultaneously of loosely adherent and firmly adherent copper deposits and the thickness of said coating being determined for any given area thereof by multiplying the number of immersion periods necessary to form a firmly adherent copper deposit times said predetermined dissolution rate.

Electrocleaner for Brass

U. S. Patent 2,830,942. *April* 15, 1958. *R. H. Elliott, Jr.*

In a method for electrocleaning brass the improvement which comprises cleaning said brass by exposing it to direct current in a bath consisting essentially of water, from five to fifteen parts by weight of glucose, from two to ten parts by weight of sodium meta silicate, and an amount of caustic soda equivalent to from fifteen to twenty-five parts by weight of one hundred percent sodium hydroxide, and then exposing said brass to reverse current in a bath comprising water, from five to fifteen parts by weight of glucose, from two to ten parts by weight of sodium meta silicate, and an amount of caustic

soda equivalent to from fifteen to twenty-five parts by weight of one hundred percent sodium hydroxide.

Plating Adhesion Tester

U. S. Patent 2,831,346. *April* 22, 1958. *R. S. Brescka, H. W. Clifford and R. L. Moore, assignors to Western Electric Co.*

A plating adhesion tester comprising means to rotatably support a supply of tape having adhesive material on one side thereof, means to move the tape continuously longitudinally in a given path, means disposed adjacent the path to force the adhesive side of the tape under a predetermined pressure into close engagement with a plated surface of an article to be tested while moving with the tape, and means to cause separation of the article and tape during continuous longitudinal movement of the article with the tape.

Apparatus for Cleaning Paint Rollers

U. S. Patent 2,831,488. *April* 22, 1958. *G. A. Anderson.*

A cleaner for paint applicator rollers comprising, a casing having a continuous, vertical side wall, a bottom wall, and a top wall, said bottom wall having a plurality of openings therein providing unrestricted drainage therefrom.

Lead-Indium Bath

U. S. Patent 2,831,803. *April* 22, 1958. *W. J. Waterman and V. E. Gripp, assignors to Vandervell Products Ltd.*

In a process for the codeposition of lead and indium by electrolysis of an aqueous bath containing soluble compounds of lead and indium and a controlling agent selected from the group consisting of the water-soluble salts of ethylenediaminetetraacetic acid, propylenediaminetetraacetic acids and cyclohexane 1.2 diaminotetraacetic acid, and employing an insoluble anode, the improvement which consists in minimizing oxidation of the controlling agent by maintaining in the bath a significant concentration of hydrazine sufficient to effect said minimizing of oxidation.

Acid Pickling Solution

U. S. Patent 2,831,814. *April* 22, 1958. *A. E. Chester and J. T. Irwin, said Chester assignor to Poor & Company.*

A sulfuric acid pickling bath containing 6% to 20% sulfuric acid, sodium ferrocyanide and sodium thiosulfate, the quantity of sodium thiosulfate being sufficient to liberate about 1 to 8 parts colloidal reactive sulfur per 5000 parts of H_2SO_4 and the quantity of sodium ferrocyanide being approximately 1.5 to 10 times the quantity of sodium thiosulfate.

Paint Brush Cleaning

U. S. Patent 2,832,156. *April* 29, 1958. *J. E. Johnson*

Apparatus for cleaning paint and surface material from paint brush bristles comprising a pair of U-shaped straps adapted to engage the side edges of a paint brush handle.

Article Sprayer

U. S. Patent 2,832,308. *April* 29, 1958. *H. A. Schmidt, assignor to ACF Industries, Inc.*

In an apparatus for applying a coating to the edges of a plurality of planar wafers the combination comprising a spray device, an orifice formed in said device to direct the discharge jet, means for holding a series of wafers in contiguity to present the edges thereof to the said orifice, said holding means formed to shield the wafer edges in part at least from the discharge jet, means for reciprocating at a uniform rate said holding means in a plane spaced from said orifice, and means responsive to movement of said reciprocating means to a predetermined position to terminate the discharge jet and to rotate the said holding means to present a successive edge to the said spray device.

Cleaning — Phosphating Composition

U. S. Patent 2,832,706. *April* 29, 1958. *B. Toubes, assignor to Victor Chemical Works.*

A composition suitable for cleaning and treating metal consisting essentially of about 70 to 85% by weight of an alkali metal acid phosphate, about 5 to 20% by weight of an alkali metal oxalate, and a minor proportion of an acid stable, synthetic organic wetting agent.

Conversion Coating

U. S. Patent 2,832,707. *April* 29, 1958. *F. Rossteutscher, assignor to Farbwerke Hoechst Aktiengesellschaft vormals Meister Lucius & Bruning.*

A process for producing surface layers on iron and steel articles in a strongly acid bath which comprises exposing the surface of such article at a temperature ranging between about 15°C. and about 50°C. to the reaction of an aqueous solution having a pH of from about 1.0 to about 2.5 and containing per liter of solution (*a*) an alkali metal chlorate in a concentration of from about 7 to about 15 grams, (*b*) a substance selected from the group consisting of oxalic acid, alkali metal oxalates, and ammonium oxalate, in a concentration of from about 5 to about 25 grams; and (*c*) a compound selected from the group consisting of metaphosphoric, ortho-phosphoric, pyrophosphoric, and poly-phosphoric acids, and the alkali metal and primary ammonium salts thereof in a concentration of from about 5 to about 60 grams.

Treating Stainless Steel

U. S. Patent 2,832,708. *April* 29, 1958. *E. L. Karchner, assignor to General Motors Corp.*

A method of treating stainless steels which comprises immersing the stainless steel in an aqueous solution containing about 3 to 10% by weight chromic acid and 2 to 5% by weight commercial orthophosphoric acid (85% acid), said solution being maintained at a temperature within the range of about 170 to 190°F., leaving the stainless steel part in said solution for a time of about at least 10 minutes and thereafter removing the stainless steel part from said solution.

Iron-Zinc Bath

U. S. Patent 2,832,729. *April* 29, 1958. *W. H. Safranek, assignor to Rockwell Spring and Axle Co.*

The process of electrodepositing a leveling, ductile, iron-zinc-alloy plate which comprises electrolyzing an aqueous acid solution containing a ferrous compound with ferrous ion in a concentration of 20 to 100 g./L, and a zinc compound with zinc ion in a zinc-ferrous ratio of from 0.004 to 0.05.

Roller Coating Machine

U. S. Patent 2,833,073. *May* 6, 1958. *A. E. Doggett.*

A roller device for painting and applying a design to a surface in a single operation.

Buffing Wheel

U. S. Patent 2,833,637. *May* 5, 1958. *H. G. Zucker and W. S. Wilkinson, assignors to Hanson-Van Winkle-Munning Co.*

A buffing wheel section comprising

an assemblage of a plurality of layers of woven cloth, each of said layers of cloth being uniformly but lightly impregnated throughout its entire body with a lubricant composition free of any abrasive and including a non-drying fatty acid as an essential constituent.

Gas Plating

U. S. Patent 2,833,676. *May* 6, 1958. *J. D. Heibel and J. W. Schell, assignors to Erie Resistor Corp.*

A method of gas plating copper coatings on the surface of titanate ceramic dielectrics.

Lacquering Steel Strip

U. S. Patent 2,833,672. *May* 6, 1958. *A. N. Laubscher and G. H. Rendel, assignors to U. S. Steel Corp.*

In a method of coating ferrous-metal strip, the steps comprising drawing the strip along a predetermined path at a speed of several hundred f. p. m., applying a continuous film of liquid containing a volatile solvent to at least one surface thereof, at one point in said path, progressively heating the strip immediately thereafter to a temperature between 500 and 800°F. substantially instantaneously and before substantial evaporation of the solvent from the film, by electro-magnetic induction, thereby flashing the solvent into vapor, and immediately thereafter bringing the heated strip into contact with cooling fluid in a region closely adjacent said point of heating, thereby cooling the strip at a rate at least equal to that at which it was heated.

Coating Aluminum

U. S. Patent 2,833,679. *May* 6, 1958. *M. A. Steinberg, assignor to Horizons, Inc.*

A method of coating aluminum and aluminum-base alloys with a coating metal which is more electronegative than aluminum, which comprises establishing a molten body of the coating metal and forming on at least a portion of the surface of said molten body of coating metal a fused, homogeneous salt composition comprising a major amount of an aluminum chloride-alkali metal chloride constituent consisting essentially of between about 52 mol percent and 82 mol percent of aluminum chloride and between about 18 mol percent and 48 mol percent of at least one alkali metal chloride from the group consisting of sodium chloride, potassium chloride and lithium chloride, and between about 1 percent and 25 percent by weight of the aluminum chloride-alkali metal chloride constituent of a chloride of at least one metal from the group consisting of zinc chloride, stannous chloride, lead chloride and cadmium chloride.

ABSTRACTS

Passivation of Zinc Coatings in Chromate Solutions

By W. Huber. (Paper read at Swiss Technical Plating Society Congress.)

Details were given in this paper of the chromate dip process and a comparison also made with other processes. The data were obtained from comparative investigations. A protective film is formed on zinc in chromic acid solutions. In particular, zinc coatings plated from potassium cyanide baths can be chemically polished, by which the surface attains a chrome-like brilliance. Solutions of chromic-sulfuric acid, chromic-hydrochloric acids, and nitric acid-hydrogen peroxide mixtures, are used.

The first process for the production of protective coatings on zinc was the Cronak process, which found considerable application. The parts (either zinc or zinc plated) are dipped at 20-25°C. for 10-20 seconds in 200 g./l. sodium dichromate and 6.6 cc./l. sulfuric acid. A yellowish green iridescent film is formed on the surface after this treatment which shows a good corrosion resistance.

While the concentration of the sodium dichromate in the treatment solution has no special influence on the thickness of the protective film being produced, the concentration of the sulfuric acid is of extremely great significance. It has an influence on the thickness of the coating and on the loss in weight on the zinc itself.

There are some treatment processes on the market which may be termed useless. Details were then given of comprehensive tests made with the proprietary chromate dip processes.

Porosity Testing of Tin Coatings on Tinplate

By W. E. Hoare. (Paper read at the International Tin Research Congress, Hannover, Germany.)

Ascertainment of the porosity of the coating is not to be recommended as a regular acceptance test for tinplate for food can pack manufacture. The differences in porosity between test pieces from the same shipment will be found to be unusually high. Some of the porosity determinations, in any case, are not suitable for practical application in the plant. Finally, the quantitative determination of numerical values is a very difficult procedure.

The test method using paper or gelatine soaked in ferricyanide and applied to the tinplate surface has a number of disadvantages. It has the advantage however, that it is simple. The results depend on the presence and the nature of the surface film on the tinplate. Additions to the test solution, to speed up the reaction and the test process, often serve to give false results.

The hot water test is extremely simple, but requires great skill to obtain useful results. The results obtained depend strongly on the water used and on the nature of the surface film on the tinplate. This process is not suitable for thin plated tin coatings.

The thiocyanate test developed by J. Kerr can be conducted with greater certainty. It has the advantage that the results can be expressed numerically. The test pieces, preferably, should be previously cleaned cathodically and then immersed for 15 minutes in a solution which contains 10 g. acetic acid, 20 g. ammonium thiocyanate and 10 g. hydrogen peroxide per liter. The coating remains unattacked while the iron exposed at the pores gives a red coloration by reaction with the thiocyanate. The intensity of the color, which can be measured colorimetrically, corresponds to the surface of iron exposed. The results are best expressed in mg. of dissolved iron per 100 sq. cm. of test surface.

It has been found that the values of the thiocyanate test can be noticeably influenced by the surface condition of the tinplate, particularly as regards the oxide film. For this reason, it is generally recommended to previously clean the test pieces cathodically in dilute alkali. With the normal tinplate sheet for can manufacture, the thiocyanate values for porosity can vary considerably at different parts of each sheet. For this reason, it is recommended to conduct the operation on test pieces which are as large as possible, i.e. of the order of 20 cm. x 20 cm.

A newly developed test method is that by which the tinplate is attacked

by a moist sulfur dioxide atmosphere. This process is based on the fact that tin is not appreciably attacked by a moist but unsaturated atmosphere which contains sulfur dioxide.

Developments and Trends In Electrotinning Lines for Tinplate Manufacture

By B. Keysselitz. (Paper read at the International Tin Research Congress, Hannover, Germany.)

There are three main types of electrotinning plants in operation. These are: the horizontal acid bath or halogen bath, the vertical or phenol sulfonate bath and the alkaline bath. All these installations are characterized by a very high throughput speed of the steel strip.

From the plating point of view, there are very considerable differences between these three electrotinning processes. The halogen bath works horizontally and only one side of the sheet is plated in individual parts of the plant. Accordingly, with the halogen electrotinning process, it is relatively simple to produce "differentially coated tinplate," which has a different weight of tin on each of the two surfaces. The hydrofluoric acid bath contains divalent tin, works at a temperature of 65°C. and permits very high current densities, up to 60 amp./sq.dm. The installations run at throughput speeds up to 800 meters/minute. As this is a corrosive bath, all tanks, pumps, pipelines, etc., must be lined with acid resistant material.

With this throughput speed, the times for the individual stages, naturally, are very short. For example, the following times have been mentioned on a tinning line of this type: Degreasing 1½ sec., pickling 3 sec., plating 4½ sec., i.e. plating each side only 2¼ sec., bright flowing 1 sec.

The phenolsulfonic acid baths are, by far, the most dominant. These installations operate with divalent tin, very good current efficiencies, and at room temperature. Because of the high current densities applied, up to 30 amp./sq.dm., the solution warms up somewhat so that it needs cooling. The throughput speed is 200 meters/min.

When the advantages and drawbacks of the various electrotinning processes are considered, the following picture emerges. The halogen installations have the advantage of a very high throughput speed. They are characterized by high current density and efficiency, but have the disadvantage of a corrosive bath and a higher working temperature.

The alkaline tinning baths have as operating advantages the non-corrosive character of the solution and the fact that, through the cleaning action of the bath, a complete cleaning is not so decisively important. Disadvantages of this bath are the high working temperature and the low current density which can be applied.

The acid sulfate lines have the advantages of low working temperature at high current densities, good current efficiencies, and simplicity of the plating process. A disadvantage is the corrosive character of the acid solution.

To the tinplate producer, any differences in quality are important. However, from many investigations, it has never been possible to prove definitely that any one of these three processes is superior to the others as regards quality of the product.

Mechanism of the Leveling Effect In Nickel Plating

By H. Leidheiser. (Paper read at the 54th Congress of the German Bunsen Society for Electrochemistry)

For the investigation there was used a Watts type nickel electrolyte of the composition: 240 g./l. $NiSO_4.6H_2O$, 45 g./l. $NiCl_2.6H_2O$, 30 g./l. H_3BO_3, to which commercial leveling and brightener addition agents were added. The leveling action of the bath was ascertained by deposition on points, over pit craters and projections. It was found that craters were leveled out to a considerable extent; on the other hand, it was found that a normal bright nickel bath gave only a slight filling of the craters.

The following conclusions were arrived at regarding the mechanism of leveling in nickel plating:

During deposition, adsorbed organic molecules at the cathode surface are in dynamic equilibrium with the solution. They possess a certain fraction of the cathode surface, the amount being determined by the operating conditions but mainly on the speed with which the molecules diffuse from the solution to the surface, there to replace by occlusion, reaction and desorption, the adsorbed molecules which have been lost. As the nickel ion concentration is 1,000 times greater, a greater number of nickel ions than of organic molecules always get up to the vicinity of the cathode surface.

In order to deposit a nickel ion cathodically, electrons must be passed to it and the H_2O - Ni linkages must be replaced by Ni - Ni linkages. Whatever serves to restrict the coming into being of the Ni - Ni linkages, must reduce the deposition speed. These retrictions could be caused, among other things, by foreign ions, foreign molecules or even the principal components of the bath itself.

The local formation speed of new Ni - Ni linkages, accordingly, depends on the race of the nickel ions with the usual solution partners to the active places of the cathode surface which, at the moment of impingement of a nickel ion, would be in the position to produce Ni - Ni linkage. If the nickel ion loses this race, then it must wander further over its surface or in its immediate vicinity until it finally finds a free active place. If one now considers the simultaneous striving of an organic molecule for the same place at the cathode surface, then the wandering and diffusion speed of this into a microscopic surface roughness will be smaller than that of the nickel ion so that, in such recesses, a nickel ion will more frequently find a free active position and here the formation speed of the Ni - Ni linkages, i.e. the metal depositing speed, is greater than on neighboring surfaces.

Brightening and leveling are, in principle, similar to one another and only differ in that, with brightening, the nickel ions wander over much shorter distances than with leveling. In bright nickel baths, cathodic overvoltages of 10-30 mv are measured; in leveling baths, under similar experimental conditions, 50-120 mv. This polarization is associated with impedance of the formation of new Ni - Ni linkages.

The reduction in the grain size and orientation of deposits found in the presence of cathodic polarizing-acting organic molecules signifies, accordingly, that these molecules raise the preference for certain directions of the Ni - Ni linkages relative to the cathode surface. If organic molecules compete with nickel ions at the surface places, then the nickel ion has no other choice than to seize any linkage possibility, without consideration to its direction. According to the type of the organic molecule, on certain crystal surfaces, there may more frequently be available linkage places than on others.

Recent Developments

NEW METHODS, MATERIALS AND EQUIPMENT FOR THE METAL FINISHING INDUSTRIES

Electrostatic Hand Spray Gun

Ransburg Electro-Coating Corp., Dept. MF, Indianapolis 23, *Ind.*

The advantages of the manufacturer's No. 2 Electro-Spray Process heretofore available only in the automatic units, now can be had in a hand-operated spray gun, which does not require conveyorized production. The gun consists of a No. 2 Process atomizing bell incorporated into a lightweight unit designed for manual operation.

A special voltage pack is connected with a flexible cable to the gun, creating an electrostatic field between the atomizing bell and the article to be coated. The article must be electrically grounded. Coating material is supplied to the atomizer by either pump unit or pressure tank. Rotation of the atomizing bell feeds the liquid to its outer edge. Atomization occurs under the influence of the electrostatic field, producing a spray of electrically charged particles. Electrostatic forces attract the spray to the article, and essentially all of the spray is deposited on the article. As in the automatic system, no compressed air is used for atomization.

In many cases, the gun has a painting rate equivalent to a conventional air spray gun. It is considerably faster on certain types of articles, such as those fabricated from perforated and expanded metals, tubing, rod, and wire. This feature is due to the "wrap-around" nature of electrostatic spray, which paints all sides of such shapes from one side only. Full benefit of wrap-around is obtained, since there is no blast of atomizing air to cause coating material to bounce from or blow by the article. And, since there is almost no overspray loss, conventional spray booth equipment is not required.

Textured Vinyl Finish

Metal & Thermit Corp., Dept. MF, Rahway, N. J.

Claimed to be up to five times more resistant to abrasion than conventional textured alkyd urea enamels and highly resistant to corrosives, Unichrome Coating B-64 provides a hard yet flexible finish. This new vinyl organosol is available in an unlimited array of colors, and the finish can be applied in various degrees of sheen in pebble texture or smooth finish. And, because it is hard yet flexible, it will not mar or crack. It withstands perspiration, ink, beverages, commercial cleaning preparations, as well as many other acid or alkaline corrosives. Dirt and stains can be readily removed without damaging the original color and texture.

The coating has unique advantages as a finish for parts made of fiber glass polyester resin and phenolic moldings since baking temperatures are significantly lower than required for vinyl plastisols and organosols. Application procedures are simple and economical. It can be easily sprayed with standard paint equipment or electrostatic processes. Another feature of the textured finish is that it masks imperfections in metal surfaces, thereby minimizing rejects.

Adhesive for Bonding New Concrete to Old

Ceilcote Co., Dept. MF, 4844 Ridge Road, Cleveland 9, *Ohio.*

A new high-strength adhesive bonds a wide range of materials to each other or to dissimilar materials. Ceilcote Adhesive No. 348 is especially recommended for bonding new concrete to old concrete but can also be used to bond steel, brass, aluminum, wood and certain plastics to each other or to concrete.

In bonding new concrete to old, the new adhesive provides a positive seal that prevents moisture from seeping in around the joints and causing spalling, flaking and gradual disintegration of the patched area. Because it has a high tensile strength, the joint is actually stronger than the surrounding concrete. New concrete can be poured 30 to 60 minutes after the initial application.

Other significant properties are a long pot-life of 1½ to 2 hours, fast setting time of 3 to 4 hours and excellent coverage.

Chromium Plating Unit

George L. Nankervis Co., Dept. MF, 15300 Fullerton Ave., Detroit 27, *Mich.*

The new Hard Chromer provides a complete on-the-spot facility for precision hard chromium finishing of tools, gauges, and other parts. A key feature of the unit is that it enables plating to within 0.0001 inch, eliminating the need for expensive grinding operations after plating. The package consists of tanks, rectifiers, automatic heating elements and controls.

The unit is completely self contained, easy to install, and can be operated by relatively unskilled personnel. It is delivered ready for immediate connection to water, power and drain. Furthermore, a comprehensive training program for operators is available.

Water-Cooled Silicon Rectifier

General Electric Co., Dept. MF, Schenectady 5, *N. Y.*

A new water-cooled silicon rectifier, designed to provide either regulated or unregulated d-c power, employs saturable reactor-amplistat control to maintain the desired current level within plus or minus one percent with

Plating Progress

Published by SEL-REX CORPORATION

DECEMBER 1958 NUTLEY 10, NEW JERSEY No. 6

Custom-Built Plating Facility At "Off The Shelf" Equipment Cost

The push-button plating facility pictured above was custom-built and installed for a prominent manufacturer of aircraft components and scientific instruments. The facility includes all equipment required for mass-production electroplating with a wide variety of base and precious metals... rectifiers, plating equipment, tanks, waste treatment arrangement, plumbing and ventilation.

Prior to the installation, Sel-Rex Engineers conducted a thorough survey and evaluation of the specific requirements —at no cost or obligation. Sketches and specifications which were then submitted reflected the considered recommendations of technical specialists completely familiar with the customer's needs.

The safe, unobstructed work areas and passageways are made possible through placement of all plumbing, waste treatment conveyors, and electrical wiring beneath the floor. Custom-engineered fiberglass ventilation equipment and ductwork was also placed beneath the floor, to handle the peculiar requirements of an electroplating operation.

Cost accountancy analysis indicate that this extensive plating facility—custom-built to the customer's specific requirements—had been purchased at no premium in price over "stock" equipment available from other sources.

If you are planning a plating facility installation, modernization or expansion, Sel-Rex maintains a complete engineering service to assist you in plant layout, design and installation—as well as quality equipment custom-built to your particular needs.

For more information and other case histories, ask for PD & L.

Printed Circuit Photo Resist Removed By Quick Dip In New Sel-Rex Resistrip

Most photo resist materials used in printed circuit manufacturing may be removed by a 30-second dip in SEL-REX RESISTRIP. The new cold stripping solution can increase production substantially because: (1) It reduces stripping time to a fraction of the time previously required. (2) Results in chemically cleaner surfaces ready for plating or dip soldering.

RESISTRIP contains a special ingredient to minimize rejects of completed circuit boards. If the initial 30-second dip does not remove all traces of photo resist, it will show up clearly as brownish film. No more rejects due to faulty plating or short circuiting often traceable to incomplete removal of photo resist. Unlike conventional acetones or ketones, RESISTRIP is non-combustible and long-lived. An "emulsifying blanket" retards evaporation for greater economy.

RESISTRIP is priced at $4.50 per gallon, f.o.b. Skaneateles, N. Y. For quantity discount schedules and full technical data, ask for RD.

Boiling Water, Salt-Spray, Mandrel-Bend Tests Can't Harm New Acid Gold Plate

Several of the country's leading transistor manufacturers have demonstrated that semiconductor products coated with 25 to 50 millionths of an inch of Autronex Acid Gold, easily pass all the rigid performance-acceptance tests. The standard ASTM 96-hour salt-spray test—*in conjunction with the severe mandrel-bend test*—left Autronex gold plate unaffected.

An important step in transistor manufacturing entails a 30 to 40 second dip —(the C.P.–4 etch) a highly corrosive solution of nitric, acetic and hydrofluoric acids and bromine, in order to remove impurities from the silicon or germanium. Most metals dissolve readily in this highly reactive solution. Autronex gold plated transistor headers were suspended in the C.P.–4 solution for *several hours;* the glass seals dissolved... the Autronex gold plate was unaffected.

Autronex Acid Gold plating process' electrolyte is mildly acidic (pH 3.5-4.5), and operates at room temperature. The process produces deposits which are mirror-bright in any thickness directly from the bath, which offer approximately 75% greater resistance to abrasive-wear over conventional gold plate.

A technical paper with complete details on bath preparation and control, equipment required, and charts on physical properties is available free for the asking.

Ask for #AG-2.

FREE LITERATURE CORNER

Just Off The Press...

- ☐ PD&L • Custom Plating Installations—Case Histories Illustrated
- ☐ RD • RESISTRIP Photo Resist Stripper—Technical Data & quantity Discounts
- ☐ PPB-1 • Sel-Rex Portable Plating Barrels—Illustrated Bulletin
- ☐ PMF • Pre-Met Filter—Illustrated Bulletin on leak-proof filter

Still Available...

- ☐ RX-2 • Rhodium Electroplating Processes—24 pages demonstrations and charts.
- ☐ PR-1 • Guide to Plating Rectifiers—20 pages illustrated
- ☐ PC-1 • Printed Circuits Plating Developments—Technical reprint—4 pages
- ☐ BR-a • Gold Plating Industrial & Decorative—8 pages, illustrated.

NOTE: For your convenience, when requesting the literature you want, simply refer to it by the prefixed code.

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unit efficiencies ranging from 90 to 95 percent depending upon voltage rating of the equipment.

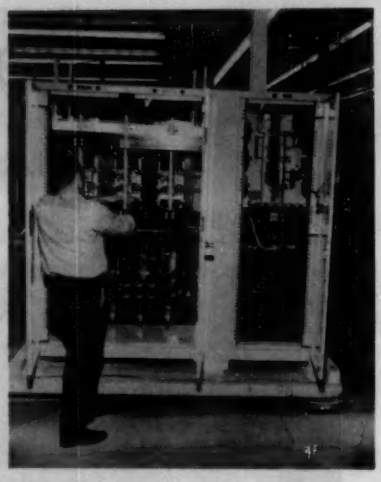
Available in ratings of 1,000 to 10,000 amperes at voltages up to 300, the rectifier may be either manually or automatically controlled by means of the saturable reactor which provides smooth, stepless control from 10 to 125 percent current output.

One outstanding feature of the new rectifier is the short circuit limiting capabilities of the saturable reactor which successfully restricts short circuit current to a value about 20 percent greater than the current prior to the short circuit. The rectifier is designed to withstand such an output without damage to components.

A completely sealed cell-cooling system greatly reduces the possibility of leaks and provides more efficient cooling than that found in similar units, design engineers said. Use of a water-cooled bus bar completely eliminates the need for rings and gaskets and makes it possible to change cells without draining the system.

To provide for rapid fault isolation and simplified maintenance, the panel is equipped with indicating lights and an alarm bell which indicate the following abnormal conditions: transformer over-temperature, reactor over-temperature, cooling water over-temperature, water flow failure, and power fuse.

Each silicon cell — $\frac{3}{16}$ of an inch in diameter — is connected to a fast-acting, current-limiting fuse that quickly



removes the cell from service if it fails to rectify and, at the same time, maintains operation of the rectifier. In the event that a fuse is blown, a fuse monitoring circuit sounds an alarm and makes a count of blown fuses. The rectifier remains in operation unless two or more fuses are blown in the same phase.

Two fans are used to compensate for heat losses occurring in the transformer and saturable reactor. Provision has been made for the installation of filters if desired.

Phosphate Coating for Steel and Iron

Octagon Process, Inc., Dept. MF, 37 *Bank St., Staten Island* 1, *N. Y.*

Paint-Grip 200 produces a fine grain crystalline coating of insoluble metallic phosphates of low porosity and superior "gripping" properties. Flaking and peeling of paint, lacquer, enamel or plastic finishes are reduced to a minimum. If finish becomes marred or scratched, the phosphate coating resists the spread of corrosion.

Treatment eliminates precleaning and prerinsing operations if the metal is only lightly contaminated. Light oil, grease and grime are easily removed during the phosphating operation. For best results with heavy oil, grease and dirt deposits, precleaning is recommended.

The product can be used in either modern, automatic spray or dip systems, or in a simple mild steel tank equipped with heating oil. Coating action is fast, from 20 seconds to 2 minuates, depending on metal treated and method of application.

It is available as a stock item in 100 lb. and 400 lb. polyethylene drums.

Mechanical Finishing Machine

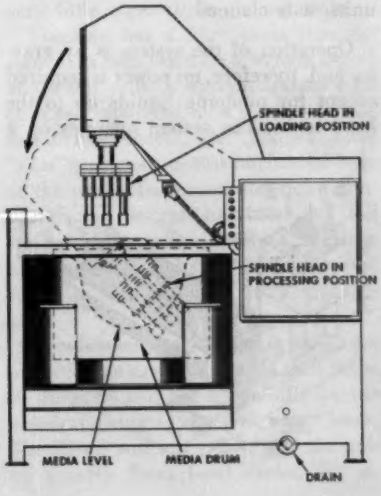
Abrado Finish Corp., Dept. MF, Grand Rapids, Mich.

The Abrado-Matic spindle finishing machine Model TS-31 consists basically of a ruggedly constructed frame and housing which supports a motor driven media tub and a pneumatically activated fixture holding spindle. The rotating tub holds the abrasive media which produces the surface finish action. The air-operated spindle provides a convenient means of immersing the fixture held parts into the rotating abrasive mass.

Flexibility of operation is maintained at all times through the use of variable speed electric motor drives for both the media tub and the fixture spindle unit. The air-operated fixtures are designed to hold one or more parts and may be easily removed or changed if necessary.

The unit includes a motor driven pump with connected pipes, sprays, valves, collection ring and sump to recirculate water-based processing solutions containing a suitable chemical compound. Complete control of the processing time cycle is maintained by an accurate electric timer. The established operations sequence is automatically repeated by the manual pressing of the operation starting button.

All electrical equipment is housed in an approved metal cabinet attached to the side of the machine for easy access. All operation controls are conveniently located at the operator's station. The operator has complete control of the machine at all times and, as an added safety precaution, an emergency master shut-off button is conveniently located on either of the operator's right or left, whichever is more preferable.



The process is generally of short duration compared to similar processes using abrasive media. Often a 15 or 30 seconds processing cycle is sufficient, although longer processing cycles ranging up to 5 or more minutes may be used. The fixture may be designed to hold a single part, two parts, or even four or more parts depending upon their size and shape. Since parts are fixtured, there is no danger of impingements, nicks, or scratches from parts colliding with one another during the process. By using different types and sizes of abrasive media, together with appropriate tub speeds, a wide variety of processing conditions can be obtained; which in turn makes the unit widely adaptable to a variety of possible applications.

The entire unit will fit into 8½ feet by 4½ feet of floor space and has an over-all height of 8 feet. No special foundation or floor support is necessary as long as the surface is firm, flat, fairly level and has a suitable drainage system. The water supply can be handled satisfactorily from a ¾" line. The air supply can be handled with a ⅜" line and should have a minimum of 75 psi air pressure. Standard units are wired for 220/440 volts, 3-phase, 60-cycle electric power.

Further information on this machine may be obtained by writing directly to the manufacturer.

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Rectifier Stack Conversion Kit

Dresser Electric Co., Dept. MF, 2705 Wight St., Detroit 7, Mich.

A new silicon conversion kit for modernizing magnesium - copper sulphide and selenium rectifiers, is designed as a direct replacement for existing rectifier stacks, and will substantially reduce operating and maintenance costs, it is claimed.

Silicon, unlike magnesium - copper sulphide and selenium, has no aging characteristic and can be stored for extended periods of time without any adverse effects on the cells. Each cell is hermetically sealed to guard against moisture and plating-room atmospheres.

All necessary parts, together with detailed instructions, are supplied with each kit for complete and simple installation.

Conn produces the "heart" of good tone quality by electrodeposition, with "Plus-4" Copper Anodes

In a cornet or trumpet, good tone and easy playing depend largely on the inside shape and finish of the tone chamber (mouthpipe).

Aiming at perfection, C. G. Conn, Ltd., famous maker of band instruments, turned to forming these critical parts by electrodeposition of copper on stainless steel mandrels. The deposited copper conforms perfectly to the precision mandrel—providing the exact taper and dimensions every time. It also gives the smooth mirror-like inside surface that prevents acoustical losses. Even minor irregularities caused by forming sheet metal or tube can muffle, distort, or rattle the tone.

Using "Plus-4" Phosphorized Copper Anodes in its acid-copper electroplating tanks, Conn has found it gets the smooth, dense deposit it needs. The build-up of metal is fast and uniform; "Plus-4" Anodes' extra "throwing power" being of particular value with the tubular shapes. There are few nodules, which minimizes finishing of the outside surface. And tank maintenance is simplified.

Conn also forms the bells used in cornets, trumpets, and trombones electrolytically. This gives still further control in the precision of the entire inside tone columns of its instruments — for increased resonance and live, powerful tone.

WRITE FOR INFORMATION on how you can obtain a test quantity of "Plus-4" Anodes to supply one tank. Address: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

Top Right: Conn Electro-D Tone Chamber (mouthpipe) cut away to illustrate the "micro finish" interior surface. Chamber and mouthpiece receptacle are formed in one piece by electrodeposition; were previously two pieces soldered together. (Patent pending.)

Bottom Right: Electro-D Bell, also formed by electrodeposition.

ANACONDA®

"PLUS-4"® ANODES Phosphorized Copper

Made By The American Brass Company

Dialysis System for Acid Separation

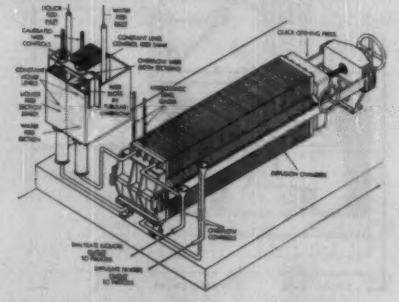
Graver Water Conditioning Co., Dept. MF, 216 West 14th St., New York 11, N. Y.

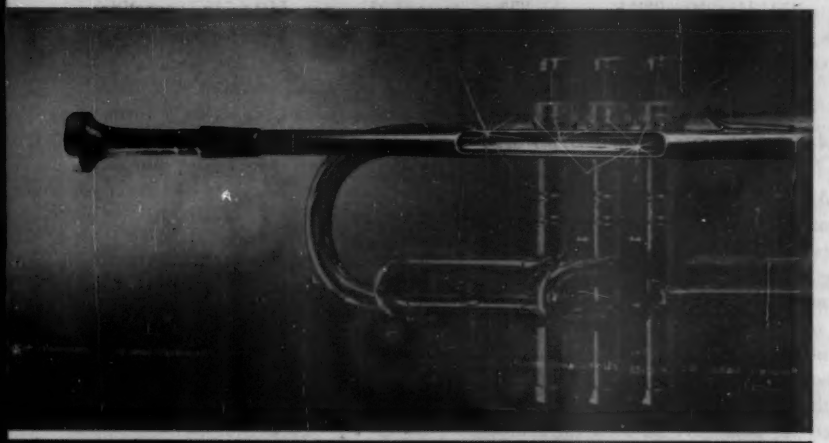
Equipment for the separation of acids and other chemicals from solution is called the Hi-Sep Dialyzer and contains the first acid-resistant membranes. The membrane is made of a new type of synthetic resin which is so tough that it will operate for a very long time without requiring replacement, repair or cleaning. Thus, instead of requiring neutralizing equipment and chemicals for the discharge of acids to waste, these industries can now purchase equipment for recovery of acids that can be reused in processing.

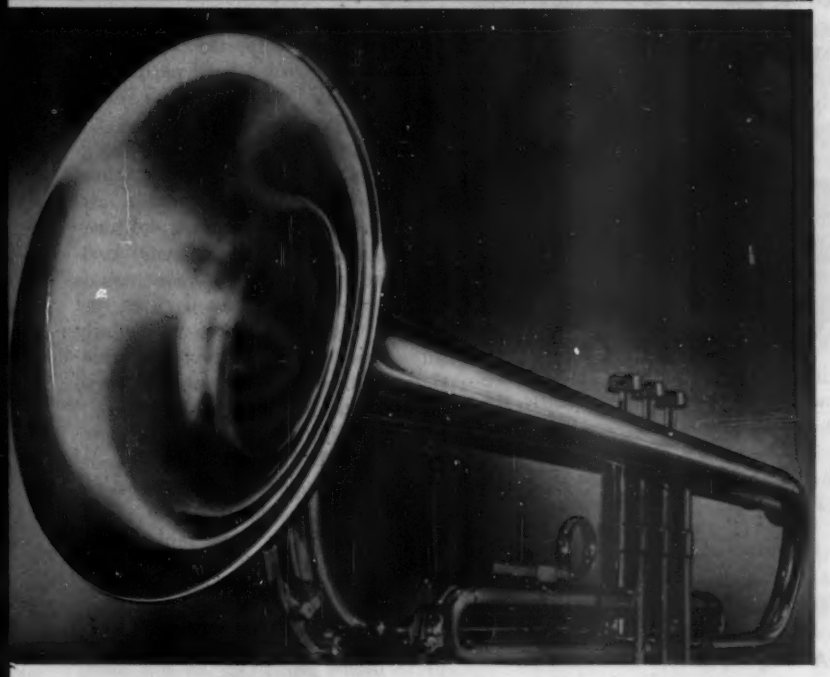
The new membrane makes possible a much wider use of dialysis than was previously known. Dialysis is a diffusion process whereby specific molecules in a liquor can be separated by being passed through a semipermeable membrane. In this way, either purification of the liquor or recovery of the acid can be accomplished. Among the chemicals which can be recovered by the process are sulphuric, hydrochloric, nitric, chromic, phosphoric and acetic acid.

The unit is an integrated system complete with head tank and flow regulators. It has an exclusive feed control which maintains a constant head, and is designed for maximum velocity and high separation. In many cases, up to 90 percent of the acid can be separated from the liquor with one of these units, it is claimed.

Operation of the system is by gravity and, therefore, no power is required except for pumping liquids up to the head tanks. The system operates on a







continuous basis and, once it is started, very little supervision is required.

The unit has a filter press type design. It is composed of alternate liquid and water cells in upright frames with each cell separated by a semipermeable membrane sheet. The frames have "ears" that rest on two horizontal bars of the press. To form water-tight compartments, the unit has head and tail stocks which when brought together under pressure by a hand-operated screw hold the frames in a vise-like grip.

The frames are of plastic and have ports. These are adjacent to each other in the press and act as conduits for the counterflowing liquid and water feeds. The liquid and water flow into the unit by gravity from head tanks. To assure continuous flow, the unit is adequately provided with air vents.

Non-Foaming Spray Wash Cleaners

Enthone Inc., Dept. MF, 442 Elm St., New Haven, Conn.

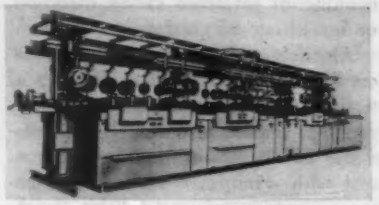
Cleaners SW-57 and SW-58, powdered alkaline materials for use in pressure spray washing machines, contain surfactants which are designed to give maximum detergency with a minimum of foam. They remove oil, solid dirt and other shop soils quickly and completely. Cleaner SW-57 is mild in alkalinity and safe for use on reactive metals such as zinc and aluminum. Cleaner SW-58 is designed for cleaning steel, copper, brass and magnesium.

Both cleaners are effective at concentrations of 1 - 4 oz./gal. and at temperatures of 150 - 200°F. They can be used in all types of spray washing machines or for tank applications using various types of agitation. For most applications, either will do the complete cleaning job; for buffing compound removal, either cleaner, used in the second stage of the washing machine, rapidly removes the emulsions or solvents remaining on the work from the first or buffing compound removal stage.

Automatic Plating Machine

The Meaker Co., Dept. MF, 1633 So. 55th Ave., Chicago 50, Ill.

Called the "Uniline," this new machine provides industry with a continuous uninterrupted high speed operation that produces extremely high quality plating. With a high speed production capacity of 120 racks per hour,



the unit handles the complete operation from cleaning to nickel and chromium plating. This new single row machine is the result of extensive research and development and, due to its sound and simple design, offers important advantages such as complete reliability of operation, ease of maintenance and minimum space requirements.

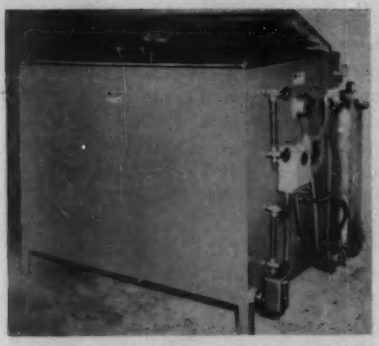
The machine is based on carefully worked out standards for construction, yet the completed machines are adaptable to a very wide range of cycle and production requirements including high lifts and wide or narrow racks.

Special carriers transport full rack load on steel rollers with permanently lubricated bearings.

Corrosion Test Cabinet

G. S. Equipment Co., Dept. MF, 15583 Brookpark Rd., Cleveland, Ohio.

New corrosion test cabinets are either stainless or mild steel, all-welded, epoxy lined and uniformly heated throughout by full-coverage water jackets on all four sides and bottom, which eliminates all danger of "hot bottom" and secondary galvanic acceleration of corrosion. It features higher test-heats (up to 150°F). All



temperatures are held to ±½°F, closest tolerance achieved by any cabinet. Test results are within 10% of absolute duplication, it is claimed.

Removable H-T Plexiglas transparent lid is an important visual aid factor for observing tests in progress without opening cabinet, interrupting process, or distributing specimens. Cam-type (non-fastening) gravity hinges, front and back, provide for easy manual opening of lid from either direction, or for lifting off entirely.

Also featured are removable salt reservoir and cover for all three types of testing: Salt Fog, Humidity, and Corrodkote. Important optionals are automatic bubble tower liquid level control with strainer, complete air compressor equipment, and full kit of cabinet exhaust accessories.

The unit meets A.S.T.M. and U. S. Gov't specifications for such equipment. 110V or 220/single phase/3.5 KW. (Optional) 220V, 440V, or 660V/3 phase/with 110V control.

Low-Sludge Nickel Anode

Hanson-Van Winkle-Munning Co., Dept. MF, Matawan, N. J.

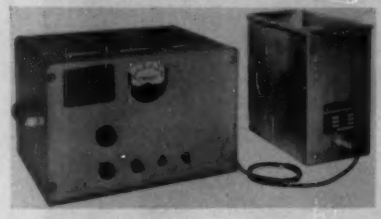
Recessed surfaces are claimed easier and less expensive to nickel plate with anodes cast as a new low-sludge alloy, which corrodes evenly, producing minimum metallic and carbon sediment. No anode bags are required. Patent applications have been filed.

Substantial markets for the new alloy are anticipated in the form of auxiliary anodes used to plate bright nickel areas of low current density. For instance, it has been difficult to acquire a smooth nickel coating on the insides of coffee percolators using the normal cycle of: clean, pickle, cyanide copper flash, bright nickel and chromium plate. It is not feasible to use anode bags in this cycle, because anode bags will carry over contaminating solutions and cause anode polarization. If the typical nickel anodes are used without bags, the nickel deposit will be rough. The new Lo-Sludge alloy is designed to solve this and similar problems.

Ultrasonic Cleaner

Alcar Instruments, Inc., Dept. MF, 17 Industrial Ave., Little Ferry, N. J.

A new low frequency ultrasonic cleaner for small parts cleaning consists of an electronic generator delivering 60 watts average, 240 watts peak of energy to crystal transducers mounted on a one gallon stainless steel tank. A novel feature of this unit is that two cleaning tanks may be used alternately without disconnecting either one, so that one tank may be used for removing large amounts of soil and the other may be used for final cleaning or two different solutions may be used. The only controls are an off-on switch, a frequency adjusting knob and a toggle



switch to operate either transducer. New rugged transducers recently developed make this an unusually rugged design. Units are guaranteed for two years, and sell for $350.00 with one cleaning tank.

Removable Plastic Coatings

Guard Coatings Corp., Dept. MF, 8-05 43rd Ave., Long Island City 1, N. Y.

A complete line of removable plastic coatings for temporary protection of highly finished surfaces, which are easily damaged during fabrication, handling and shipping, is furnished in the form of liquid plastic solutions which are applied to the highly finished surface by conventional coating techniques. When dry, they form tough, abrasion-resistant films. Two general classes of coatings are available; fast drying solvent solutions and plastic water dispersions. Coatings are removed simply and rapidly by one of four methods, depending upon the particular product used; peeling by hand, dissolving in a vapor degreaser, dissolving in mild alkali solution or by wetting film with water.

The specific product to be used in any particular application is determined by the degree and type of protection required, the surface to be protected, the manufacturing operations to which the protected surface is subjected.

Some of these coatings can be left on the fabricated object as a form of protective packaging, or may be used exclusively for packaging purposes. These products offer the lowest cost temporary protection available.

Wear-Resistant Electrodeposits

CEM Division, Platecraft of America, Inc., Dept. MF, 570 Tifft St., Buffalo 20, N. Y.

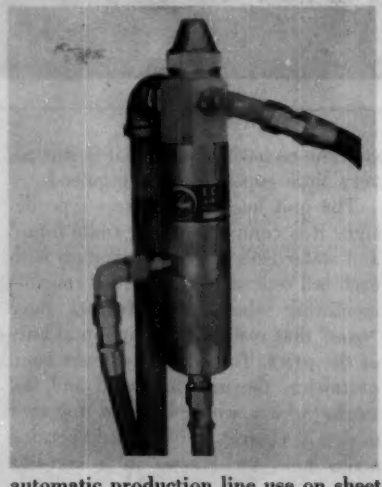
A new method of applying unique abrasion-wear, and corrosion-resistant coatings to metal parts, known as CEM (Composite Electrochemical Materials), yields a composite electro-coating of finely divided hard particles in a metal matrix, yet is almost as simple as conventional plating.

In addition to silicon carbide, tungsten carbide, titanium carbide, chromium carbide, aluminum oxide, zirconium oxide, molybdenum, and tungsten can be dispersed in metal coatings and co-formed with base metals such as: nickel, cadmium, silver and copper. Certain coatings, particularly those based on nickel, increase oxidation resistance and improve the resistance to attack by corrosion.

Automatic Spray Gun

Eclipse Air Brush Co., Dept. MF, 390 Park Ave., Newark 7, N. J.

The Guk-Rod, a tough, air-operated automatic spray gun, is designed for



automatic production line use on sheet metal fabrication. The rugged gun will work continuously for months even in a closed chamber, maintaining exceptional atomization and uniform dispersion, as well as withstanding high fluid pressures well over 500 p.s.i., and

sprays very heavy, viscous materials.

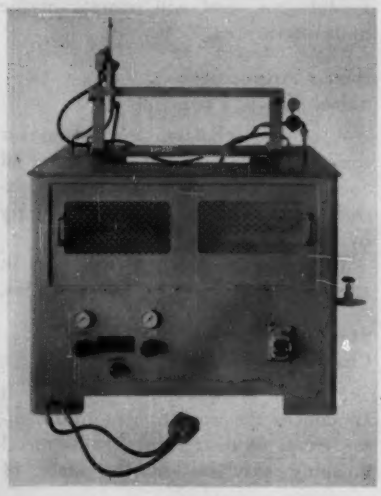
Construction is uncomplicated, yet the gun is built for high volume and long life. It features hardened moving parts such as fluid tip and plunger, and a special design carbide nozzle insert. Fluid passages are clear and have large openings — the fluid hose connection is ¾" inside diameter. Moving parts are self-aligning; a special timetested V-ring packing is used; and the air seal is protected by an extra wiping seal. For maximum results the unit opens and closes by compressed air.

Automatic Spray Painting Machine

Conforming Matrix Corp., Dept. MF, 349 Factories Bldg., Toledo 2, Ohio.

Absolutely even deposition of paint material to the same thickness over the entire area of the piece part is claimed to be assured by a new automatic spray painting machine. The positive mechanical reciprocating drive permits smooth gun travel with no pauses even when the two traversing guns reverse their direction. Thus, it is unnecessary to overshoot the part with resultant excess paint deposit on the part and mask. Gun travel can be right up to the edge of the part and then reversed. The guns paint in both directions, automatically shutting off at the end of each stroke. The machine is also ideal for companies with limited air supply, air being required only for the triggering of the spray guns.

The machine sprays areas up to 8" wide and 22" long, the length of the paint coverage depending upon the setting of the control valves, between 12" and 22". The speed of gun travel is adjustable from 35 to 90 feet per minute.



Electric motor and chain drive operation is employed, the motor being ¼ HP, 110 volt, single phase, 60 cycle, wired in accordance with NEMA Code 7 for explosion-proof purposes. The design complies with all JIC Standards and Factory Mutual.

All dials and regulators are on the face of the machine, and all working parts are totally enclosed. The mechanism is automatically oiled with pneumatic oil lubricator.

The machine is supplied complete with two automatic spray guns, and a 12" diameter round exhaust duct collar. It is 36" high, 47" long and 30½" deep. There are a number of optional features, including explosion-proof electric counter for pre-selection of number of painting strokes; explosion-proof electric timer which controls duration of loading time and maintains steady operation; air clamping hold-downs to seat flimsy or warped parts firmly into masks, and tilting guns on larger models where jobs require difficult paint angles, or can be built to suit a customer's particular requirements.

Anti-Friction Phosphate Coating

Turco Products, Inc., Dept. MF, 6135 So. Central Ave., Los Angeles 1, Calif.

A new phosphate material for use as an anti-friction "break-in" coating and as a foundation for oil or paint, Turcoat 3557 provides a coating of up to 3000 miligrams per square foot on iron, steel or cadmium.

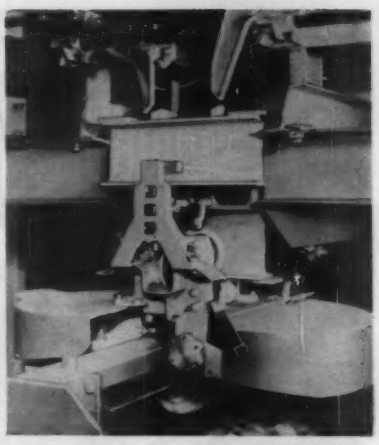
Normally used as a "break-in" coating for moving parts, it may also be used for rust-proofing of small parts to be oiled in mass production. It also serves as an excellent foundation for paint.

The new coating is applied by immersion or tumbling and meets MIL-C-12968 (ORD), Type B; USA-57-0-2C, Type II, Classes A, B and C; and JAN-C-490, Grade I. The coating applied is one of mingled manganese, zinc and iron phosphates.

Multi-Process Automation

Abbey Process Automation, Inc., Dept. MF, 27-01 48th Ave., Long Island City 1, N. Y.

15 or more different production or processing patterns (cycles) are now made optional for every carrier to perform automatically throughout standard Abbey-Matic Systems, by pre-setting a single Dial-Cycle selector on each carrier. One operator can pre-determine the course of all individual carriers in the system by simply turning the dial on each carrier to the proper number corresponding to the production or processing pattern desired — or designated by production order. Each pattern (cycle) can include any variety of operations or processes in the system, and can differ radically without conflicting movements, delays, confusion, or errors. Cycles can also be altered at any point during processing by appropriate remote re-setting at any chosen moment or altered to new requirements by simply relocating electromagnetic trippers.



High Vacuum Diffusion Pump

NRC Equipment Corp., Dept. MF, 160 Charlemont St., Newton Highlands, 61, Mass.

A new 32-inch vacuum oil diffusion pump provides the increased pumping capacity, low ultimate pressure and high forepressure tolerance now needed by many industries. Model H-32-P has a top speed above 50,000 cfm at an inlet pressure of 1×10^{-4} mm. Hg. and speeds above 30,000 cfm at pressures between 3.5×10^{-4} and 6×10^{-6} mm. Hg. Untrapped blank-off is less than 1×10^{-6} mm. Hg. and tolerable forepressure greater than 0.2 mm. Hg.

The new pump requires 10 kw of 220/440/3/60 power and 6 gallons per minute flow of water lower than 80°F. It stands 82" high, has a projected floor area of 38" x 52" and weighs a nominal 800 pounds. Backstreaming, normally a problem with large capacity diffusion pumps, is reduced to low levels by screwless jet construction and the provision of a

INVESTIGATE THIS TIME-SAVING
VARIABLE SPEED MODEL
Bench-Type Single Speed
BENCH MODEL VARIABLE SPEED
Note Carefully These
IMPORTANT POINTS
Barrels can be filled with parts or abrasive—while running.
Work can be watched — samples removed for inspection — while running.
Angle can be changed for best abrasive or polishing action — while running.
Barrels can be emptied by tilting to pouring position — while running.
Barrels are made in various sizes, shapes, and materials. They are easily replaced.
No. 5—Single Speed
No. 5—Variable Speed
No. 5A—Single Speed
No. 5A—Variable Speed
No. 6—Single Speed
No. 6—Variable Speed
If You're a Tumbler, Send for This NEW CATALOG
THE HENDERSON BROS. COMPANY
"The Tumbling Barrel People"
136 SOUTH LEONARD STREET
WATERBURY, CONNECTICUT

top jet vapor shield. Clearance of 28" between top jet and inlet flange further reduces backstreaming and provides ample space for introduction of both baffles and cold traps, should such be quired. The pump is priced at $3,575, f.o.b., Newton.

DC Power Supply

Perkin Engineering Corp., Dept. MF, 345 Kansas St., El Segundo, Calif.

A wide voltage range DC power supply with magnetic amplifier regulation is provided in standard 19" wide rack mount and is designated Model No. M-1193. It provides a DC output of 5 - 50 volts at 50 amperes from an AC input of 110, 220 or 440 volts, 60 cycle, single phase. The wide output voltage range is accomplished by means of a rotary switch which provides three separate ranges which are used in conjunction with a potentiometer to supply smooth continuous voltage adjustment over each range. Regulation accuracy is $\pm 1\%$ for line variations of $\pm 10\%$ and $\pm 1\%$ for load changes of 10% full load to full load. Ripple is 5% RMS maximum and the unit incorporates remote sensing.

BUSINESS ITEMS

Solventol Promotes Carleton A. German

Carleton A. German was recently promoted to the position of industrial sales manager of *Solventol Chemical Products, Inc.*

Carleton A. German

Mr. German started with the firm in 1944. His long experience covers the application of chemicals and the design of metal cleaning equipment in industrial processing operations. In his new position, Mr. German will be responsible for sales and service for the United States and Canada.

Edward A. Perry Joins Asarco in Cleveland

Edward A. Perry has joined *American Smelting and Refining Co.* as a technical representative in the Plating and Electroplating Department of the company's *Federated Metals Division.* A chemistry graduate of Baldwin Wallace College in Berea, Ohio, he has spent the past six years in the electroplating department of the McGean Chemical Co. in Cleveland.

Mr. Perry will make his headquarters in the Cleveland office at 1422 Euclid Ave., and will operate in the midwestern area.

Sarco Announces Scholarship Program

A college scholarship program for sons and daughters of employees of *Sarco Co., Inc.* and *Sarcotherm Controls, Inc.*, has been announced jointly by the two affiliated companies.

The scholarship program is now in effect for employees of both companies.

Stevens Appoints Chemray as Distributor

Frederic B. Stevens, Inc. of Detroit announces the appointment of *Chemray Corp.* as distributor for its metal finishing products in the state of

Illinois. Chemray is a newly founded organization, making its headquarters at 10150 Roosevelt Rd., Westchester, Ill. It is headed by *Ray Ledford*, who was formerly associated with Industrial Filter & Pump Mfg. Co. as sales manager. Mr. Ledford is well known in the metal working industry. He is a member of the American Ordnance Association, past president of the Chicago Branch of the A.E.S., first vice president of the M.F.S.A.

Automation Services Forms Division

Automation Services, Inc., Detroit 38, Mich., announces the formation of its *Hydra-Blasting Mfg. Div.* Wet-blasting, custom-designed, automatic and manual machines and process cycles, as well as specially compounded wet-blasting abrasives and related supplies are the main products of this division.

King Anodizing Gets Appointment and Expands

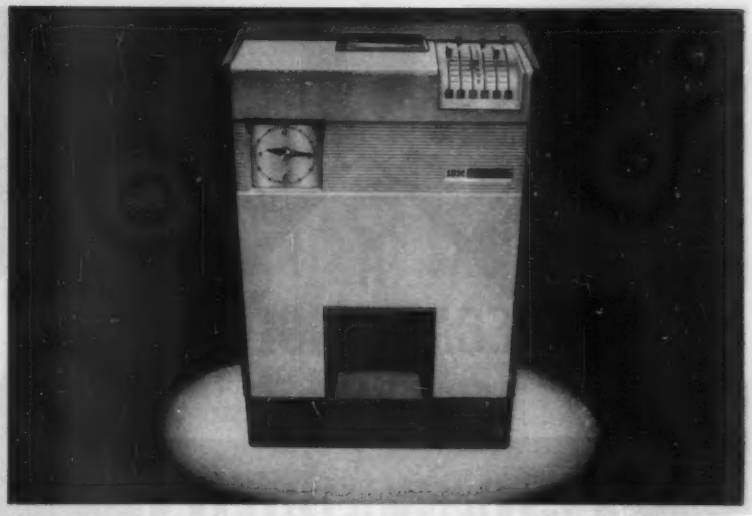
King Anodizing Co., Burbank, Calif. has been appointed exclusive Southern California contract applicator for the Sanfordize architectural and industrial aluminum hard finishing process and has simultaneously completed a $100,000 expansion program.

The installation of four large capacity tanks, a 150 ton refrigeration unit and a 500 horsepower generator as part of their expansion program now place King in a position to offer the trade a most complete, professional service on both clear or color anodize.

Colonial Supply Appoints Mackell

Leonard J. Mackell has been named abrasive engineer by *Colonial Supply Co.*, Fort Pitt Blvd., Pittsburgh, to service grinding wheel and abrasive needs of industrial firms in the Pennsylvania, Ohio, Maryland, and West Virginia area. Mr. Mackell has sold and serviced in this area for 12 years. Most recently he was associated with Kenco Industrial Equipment of Fort Lauderdale, Fla.

Leonard J. Mackell



ARMORSOL® coating on PLASTICS

New vinyl coating for thermoset plastics and polyester fiberglas.

Basically a one-coat finish, competitive with baked enamel, Armorsol can be made smooth or textured for approximately the same cost as baked enamel. Yet it is five times as abrasion resistant.

Armorsol is a new and entirely different kind of vinyl coating, and has physical and chemical properties unlike any other finish. Armorsol is the best coating for thermoset plastics.

Write today for free booklet and sample panel.

JOHN L. ARMITAGE & CO.

Synthetic Enamels, Paints, Varnishes, Lacquers

245 THOMAS STREET · · NEWARK 5, NEW JERSEY

National Plastics Moves

National Plastics Supply Co. announces their removal to a larger plant located at Burr Road at East Main St., Terryville, Conn.

More Nickel Released to Industry

Leo A. Hoegh, director of Civil and Defense Mobilization, on October 13 authorized the diversion to industry of all nickel scheduled for shipment to the government in calendar year 1959.

The diversion will make approximately 100 million pounds of nickel, both market and premium-priced, available to the civilian economy to meet demands in excess of commercial supplies in 1959.

In continuing the government's policy of full diversion of nickel for the third successive year, Mr. Hoegh said that the action was made possible by the continuing improved defense position for the metal.

Aluminum Co. of America Announces Appointment of Jack M. Schultz

Jack M. Schultz has been named

COPPER SULFATE NICKEL SULFATE

A COMPATIBLE ~TRIO~

PLATING INDUSTRY

There's reason for Triangle Brand Copper Sulfate and Nickel Sulfate being close friends with the plating industry. Over the years they have proved their DEPENDABILITY.

Why? It's obvious — purity, uniformity, solubility and high conductivity of their solutions result in *quality plating.*

All-important "extras" found in the use of Triangle Brand Copper Sulfate and Nickel Sulfate yield long-life plating performance that *makes the difference.*

Insist on Triangle Brand Copper Sulfate and Nickel Sulfate for dependable plating baths.

And remember, Phelps Dodge is also a basic producer of
SELENIUM TELLURIUM

PHELPS DODGE REFINING CORP.
300 PARK AVE. NEW YORK 22, N.Y. • 5310 W. 66th STREET, CHICAGO 38, ILL.

manager of technical sales for *Aluminum Co. of America's* pigment division.

Mr. Schultz, who has played a leading role in the development of special metallic automobile finishes during his 16 years with the firm, will assume his new duties immediately. He will coordinate efforts of the pigment sales force to expand the growing use of aluminum pigment as an industrial manufacturing product.

Mr. Schultz graduated from the University of Wisconsin in 1942 with a degree in metallurgical engineering. He then joined Alcoa, serving in various plant positions until 1945. He was then transferred to the company's Milwaukee sales office.

In 1949 he moved to Detroit, where he began his work with automobile manufacturers to develop new aluminum metallic finishes.

Magnus Chemical Appoints Dr. Rohr

The appointment of *Dr. Robert J. Rohr* to the position of director of research and development has been announced by *Magnus Chemical Co., Inc.*

In his new capacity, Dr. Rohr will be engaged in the research and development of new, specialized cleaning compounds and methods to meet industry's ever-growing need for more effective cleaning materials.

Dr. Rohr's academic background and board experience in the industrial and chemical fields along with his exceptional technical qualifications ideal-

Dr. Robert J. Rohr

ly fit him for his new position. He holds an undergraduate degree in mechanical engineering from Georgia University and a Master's and Ph.D. in chemistry from the same university. Dr. Rohr has spent many years in the sales and service of metal treating chemicals and equipment in this country and Europe. He is a member of the A.E.S. and A.S.M.E.

Protective Coatings Consultant

Dr. Walter B. Maass announces the establishment of a consulting service for the protective coatings industry at 135 Front St., New York 5, N. Y., telephone WHitehall 3-8616.

He was formerly associated with Adelphi Paint and Color Works and John L. Armitage & Co. and is a member of the American Chemical Society, the National Association of Corrosion Engineers, and the New York Paint and Varnish Production Club.

Handy & Harman Adds Two Sales Supervisory Posts

In a move toward further divisionalization of its sales organization for better concentration of sales effort, *Handy & Harman* has added two new sales supervisory posts.

E. Earle Tietz has been appointed to the new post of manager of marketing services. In this capacity he will assume responsibility for staff division functions, including advertising, brazing and arts products, industrial products, sales service and training. Mr. Tietz had previously been industrial products manager. He joined the company in 1950.

Robert E. Burke has been named to the new position of field sales manager, in which he will assume responsibility

for the firm's field sales organization. Mr. Burke had previously been New York district sales manager. He joined the company in 1937.

Clark P. Zitzmann has been named New York district sales manager; and *William K. Honan* has been appointed industrial products manager. Both men have been sales representatives for the company in the New York district for the past five years.

Graver Announces New Engineering Representative

Graver Water Conditioning Co., New York, has announced the appointment of *G. M. Wallace & Co.* as engineering representatives for the Rocky Mountain-Intermountain area. They will handle the complete line of equipment for industrial, utility and municipal water treatment, industrial waste treatment and chemical processing.

Four Wallace offices staffed by a group of power and liquid treatment specialists are located within an area offering convenient and rapid service to industry. The home office is in Denver, Colo. with branches in Butte, Mont., Salt Lake City, Utah and El Paso, Tex.

Gilbert Tramer Appoints Coulter

The Gilbert Tramer Co., manufacturers of plating and chemical equipment, announce the appointment of *Hugh P. Coulter* as sales engineer for the western section of New York.

Mr. Coulter is a chemical engineering graduate of Clarkson College and was formerly employed by Blaw-Knox Co., Buflovak Equip. Div., as a sales and design engineer for 22 years. He received his B.S. degree in 1933 and has taken post graduate engineering courses at Columbia University.

Hugh P. Coulter

Mr. Coulter's headquarters are 115 Houston Ave., Jamestown, N. Y. The telephone number is 67-025.

DeVilbiss Expands

Expansion of its Cleveland direct factory branch to provide additional customer facilities has been announced by the *DeVilbiss Co.* The branch now carries the full line of spray painting and finishing equipment, hose and hose connections, air compressors and a complete stock of service parts for all the firm's products. Complete repair service by factory-trained mechanics now is available along with engineering and sales facilities.

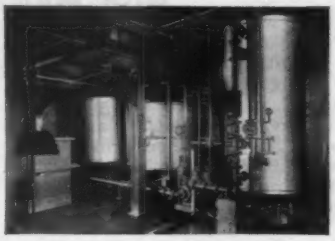
The Cleveland branch is located at 4008 East 89th St.

ionXchange

DO YOU WANT TO SAVE MONEY?

Here is how to solve some waste disposal problems -and reduce costs at the same time

IonXchangers of several types, and various units of allied equipment, as designed and manufactured by Illinois Water Treatment Company, offer a number of money-saving opportunities. *For example, consider the waste water from rinse tanks.* Contaminants can be removed and concentrated, and *pure* water returned to the rinse system. In some instances, chrome and other valuable metals can be recovered from the rinse water. *For another example, consider plating solutions* which, under many circumstances, become polluted and less efficient. The contaminating materials can be removed, recovered if valuable, and the bath maintained at high purity. Also, impurities found in water supplies, to spoil the appearance of plated or anodized parts, can be removed so that uniform quality of work is assured. Spent metal finishing solutions such as aluminum bright dip can be purified for re-use. Toxicity in otherwise-clean waste can be eliminated. All of these treatments will, in one way or another, contribute substantially to improved products, more efficient operations, and lowered costs. *Specific possibilities of applications of ionXchange in your plant can be determined by talking to your ILLCO-WAY representative.*



IonXchanger recovery unit for plating solutions

ILLINOIS WATER TREATMENT CO.
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ROCKFORD, ILLINOIS

NEW YORK OFFICE: 141 E. 44th St., New York 17, N.Y.
CANADIAN DIST.: Pumps & Softeners, Ltd., London, Can.

ILLCO-WAY

Sel-Rex Names New Managers

Alexander Korbelak has been made manager, marketing and new product development, Precious Metals Division, *Sel-Rex Corp.*, Nutley, N. J., according to an announcement. Formerly sales manager of the division, Mr. Korbelak's new duties will include new applications and new market exploration for the firm's diversified line of precious metals electroplating processes for decorative and industrial applications. He will also work closely with the division's technical staff in the development of new products for which his field work may have uncovered a need.

A graduate of Tufts College, Mr. Korbelak's background includes sev-

Photo courtesy Hanson-VanWinkle-Munning Co.

with MANHATTAN RUBBER LINING

How can you be *sure* your costly pickling and plating equipment is *permanently* protected against corrosive solutions . . . the *solutions* protected against contamination? Manhattan rubber lining engineers have the answer. Thick, multiple calendered sheets of natural or synthetic rubber are bonded to the tank metal so securely they can't be separated! Manhattan *bonded protection* has kept many tanks in continuous use over 30 years!

Manhattan Rubber Linings eliminate the dangers of stray currents in plating operations. They expand and contract with metal, won't harden, crack or oxidize — even under extreme temperature changes. Every Manhattan rubber lined tank is tested under high voltage to detect any imperfection before it is shipped to your plant.

Be *certain* of lifetime protection for your costly equipment and be protected against contamination of expensive plating baths. Specify Manhattan Lining on your next equipment or let Manhattan handle your next tank lining job. Contact the Manhattan rubber lining facilities nearest your plant.

RM-827

RUBBER LINING PLANTS AT PASSAIC, N. J. • NORTH CHARLESTON, S. C.

MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Manufacturers of Mechanical Rubber Products • Rubber Covered Equipment • Radiator Hose Fan Belts • Brake Linings & Blocks • Clutch Facings • Packings • Asbestos Textiles Engineered Plastic, and Sintered Metal Products • Abrasive & Diamond Wheels • Bowling Balls

Alexander Korbelak

eral years as an electrochemist with Seymour Mfg. Co., where he contributed to the development of their bright nickel processes. He also spent eleven years with Westinghouse Electric Corp. in their electronic, chemical and metallurgical engineering departments.

Immediately prior to joining Sel-Rex in 1954, Mr. Korbelak was editor of *Plating Magazine*. The author of several papers on the techniques of electroplating difficult metals, he holds patents on pulsating plating techniques and metal processing.

Jerry Ross has been appointed manager, Equipment Division. Sales engineer with the company since 1949, Ross had been in charge of plating equipment and supplies sales for the

Jerry Ross

past two years. In his new position, he will be responsible for engineering, pricing and surveys, for major equipment and plating facility installations. Mr. Ross already has the custom-layout and design of some of the more extensive plating facilities in the country to his credit.

A Chemical Engineering graduate of Columbia University, Mr. Ross was previously associated with DuPont in sales, research and technical service for eleven years, five years with the Carlton-Cooke Plating Co. as plant superintendent, two years with Century Plating and Engineering as plant manager, and one year with North American Aviation as superintendent of finishing.

DeWaltoff Appointed Technical Director at Octagon Process

To head up their new industrial technical service division, *Octagon Process, Inc.*, of Staten Island, N. Y., has appointed *Lionel DeWaltoff* as technical director. He is well known in industry, through his development of many processes, techniques and materials used in the plating and finishing fields. He has given many lectures and has presented papers at chemical, metal and other societies during the past quarter of a century.

Mr. DeWaltoff is a graduate of Columbia University with a B.S. degree in Chemistry, and has taken numerous courses in advanced chemistry, metallurgy, electrometallurgy and corrosion engineering at Columbia University, New York University and Stevens Institute of Technology. He is an active member of many technical and honorary societies, including the American

Lionel DeWaltoff

Chemical Society, Electrochemical Society, Faraday Society, American Electroplaters' Society, American Society for Metals, and National Ass'n. of Corrosion Engineers.

Frederic B. Stevens, Inc. Appointed Hydra-Blast Distributor

Frederic B. Stevens, Inc., 1800 Eighteenth St., Detroit, announces the addition of Hydra-Blast supplies and equipment to its metal finishing line. Hydra-Blast is a manufacturing division of *Automation Services, Inc.*, of Detroit. Mich., which produces a wet blasting process.

In addition to supplies, the 76-year old Stevens concern will also distribute the automatic or manual equipment used in the process.

Free Course in Electroplating

The course of study in electroplating given at the Fort Greene Evening High School, 27 Fort Greene Place, Brooklyn, N. Y. (formerly Brooklyn Evening Technical High School) will begin its Spring term on February 2, 1959.

The session is divided into classroom discussion and laboratory experiments. The classroom topics will include simple calculations, reading graphs, chemistry of the plating tank, pH, wetting agents, pitting, deionizing. The laboratory experiments will include solution analysis, Hull cell studies, anodizing.

Registration begins January 26, 1959, and daily thereafter from 7:00 to 8:30 p.m. Classes will meet on Tuesday and Thursday from 6:45 to 8:15 p.m. including about 6 Fridays. The term begins February 2 and ends June 25. 1959. Register with *Mr. L. Serota* in Rooms BW17 and 3E2.

Once you use it you'll Order... Again... and Again... and Again!

Every can filled with a full weight of extra high quality 99.75+% Chromic Acid. Prompt delivery made from ample factory and nearby distributor stocks.

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Changes at Wyandotte

Charles Masek and *Robert Ziegeweid* have recently joined *Wyandotte Chemicals Corp., J. B. Ford Div.*, as sales representatives in the division's Industrial Products Department, and *Frank G. Pollard* is now a member of the research staff at the firm's laboratory. Masek, working out of the Cleveland, Ohio, district office, has a combined technical-service-sales background in the chemical and plating industries. His experience covers a 15-year span. He worked on water purification problems for the Atlas Powder Co., Ravenna, Ohio, for two years, and then went with the Addressograph Multigraph Co., Euclid, Ohio, for 12 years, becoming a plating foreman, and

Charles Masek

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HANDY & HARMAN MAKES THEM 999+ OR FINER IF YOU SPECIFY

For general commercial work, Handy & Harman anodes are 999+ fine. And it makes no difference in what shape or size they're made: ball, rod, plate, strip or sheet, they all have the same uniformly high degree of purity. What's more, if you want still finer anodes, you can specify the AA grade for high-speed plating, or finer, if desired. Handy & Harman supplies them all.

Your "fineness need" is our first concern. You can be sure that you'll get *exactly* what you want in anodes from Handy & Harman... thousands of manufacturers will agree.

MANY HAPPY RETURNS

Handy & Harman Refining Service has reached a state of perfection that assures you —in lot after lot—of *accurate* returns. Your anode ends, plating solutions, precious metal scrap, sweeps and waste are more *rewardingly handled* by Handy & Harman.

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WEST COAST: 330 N. Gibson Rd., El Monte (Los Angeles), Calif.

CENTRAL U. S.: 1900 West Kinzie St., Chicago 22, Ill.

EAST COAST: 82 Fulton St., New York 38, N. Y.; Bridgeport 1 Conn.; 425 Richmond St., Providence 3, R. I

Robert Ziegeweid

an assistant foreman of chemical manufacturing. His sales experience includes sales and service work with the Platers Supply Co. of Cleveland, Ohio and with a Cleveland chemical company.

Masek holds a Bachelor of Science degree in chemistry from John Carroll University. He is a member of the A.E.S.

Mr. Ziegeweid is representing the department in the Minneapolis, Minn. area. He has been an industrial chemical representative for seven years, performing the functions of a sales engineer and servicing work to a varied clientele in the Minneapolis-Chicago area.

Pollard, in his 10 years of experience, has served several Detroit area companies. Adhesives engineer, research chemist, and research director in the adhesives industry make up his background. His experience also includes chemical sales and service in the metal finishing industry.

Frank Pollard

Born in Canada, Pollard holds a Bachelor of Science degree in Chemical Engineering from Queen's University, Kingston, Ontario, Canada. He also attended the University of Michigan, where he studied business administration. Pollard is a member of the Engineering Society of Detroit.

Manufacturers' Literature

Chemical Processes

Graver Water Conditioning Co., Dept. MF, 216 West 14th St., New York 11, N. Y.

Among the processes described in a new six page color bulletin are ion exchange, sedimentation, filtration and flotation. Equipment for each of these is illustrated and described.

A highlight of the bulletin is a section on what the latest methods of chemical processing can mean to industry. Subjects discussed include product upgrading, by-product recovery, recovery of valuable materials and processing methods.

Flowmeter

Fischer & Porter Co., Dept. MF, 822 Jacksonville Road, Hatboro, Pa.

Floguide Meter, a metal tube variable-area flow meter with a glass tube indicating extension, is described in new 4-page Specification Bulletin 10A1485.

Aluminum Processing

J. B. Ford Div., Dept. MF, Wyandotte Chemicals Corp., Wyandotte, Mich.

Products and cleaning procedures for aluminum processing is the subject of the new colorful, 11" x 17" folder. Etching, cleaning before anodizing, desmutting, paint stripping, barrel finishing, deoxidizing are among processes described.

Power Brushes

Osborn Mfg. Co., Dept. MF, 5401 Hamilton Ave., Cleveland, Ohio.

A new eight-page booklet, two color, describes the TY tools, a new concept of brushing tools for power finishing. It shows the various designs and applications of this new revolutionary brush.

Stripping Compound for Epoxy Resins

Oakite Products, Inc., Dept. MF, 19 Rector St., New York 6, N. Y.

Stripper S-A, for the stripping of epoxy resins, acrylics, vinyls, polyesters, and other hard-to-remove finishes, is described in a recently issued four-page folder.

Brush Plater

Marlane Development Co., Inc., Dept. MF, 153 E. 26th St., New York 10, N. Y.

In response to numerous inquiries, the twelve page booklet entitled "Practical Brush Plating with the Dalic Process" has been reprinted and is again available for distribution. The booklet describes the process in detail and gives photographs and descriptions of numerous engineering applications.

Plating & Processing Machine

The Meaker Co., Dept. MF, 1629 South 55th Ave., Chicago 50, Ill.

New four-page Bulletin U-658 describes the new Uniline single row plating and processing machines. The complete machine is illustrated and described with emphasis placed on the carriers, main frame and ultra-smooth, positive drive. The folder also illustrates and lists other types of machines for plating, etching and anodizing, pickling, phosphating and related processes.

Organic Coatings

Bee Chemical Co., Dept. MF, 12933 So. Stony Island Ave., Chicago 33, Ill.

A new 36 page brochure on clear and colored coatings for use on metal, plastics, glass and wood provides information on numerous coatings for application by spraying, screening and roller coating. Data are given on standard colors available including metallics, bronzeless gold and other special effects. Information relating to the application of coatings of special interest to those who use or specify coatings is also included.

"Type 160" is engineered to meet the needs where a softer buffing fabric is required, jobs where buffs must conform to irregular shapes and get down into deep recesses without throwing work out of the chucks. On complex shape work, pressures can be spread more evenly over all surfaces. Check its buff cost/performance in your shop under your conditions.

"Type 160" is now available as a trademarked fabric . . . as are the other three fabrics that make up the present line of Milliken "Fabrics Engineered for Buffs". Because each of these fabrics has different buffing characteristics, we suggest that you try out *all four*. Ask your buff supplier to make up a test lot of buffs in the styles and sizes you use. You will know you are getting a premium quality fabric because the trademark appears in the plies of each section.

DEERING, MILLIKEN & CO., INC.
1045 SIXTH AVENUE • NEW YORK 18, N.Y.

Paint for Galvanized Surfaces

Lead Industries Ass'n., Dept. MF, 60 East 42nd St., New York 17, N. Y.

A new paint formulation for the protection of galvanized surfaces regardless of their condition is described in Red Lead Technical Letter No. 13. The paint has a red lead-iron oxide-zinc dust pigmentation in an alkyd resin vehicle and is the result of six years of exposure testing. It is unique in that it may be used on rusted, weathered or treated new galvanized surfaces. It may be used as a primer in one or more coats, either exposed to the weather or covered with a suitable finish coat. Information regarding surface preparation is also included.

Electroless Nickel

Kanigen Div., General American Transportation Corp., Dept. MF, 135 S. La Salle St., Chicago 90, Ill.

Technical Bulletin No. 258 is a twelve page illustrated brochure on the Kanigen process for chemically de-

positing nickel alloy coating, without the use of electricity. Detailed information is given for the process, including chemical analysis, hardness and ductility, abrasion resistence, porosity, adhesion and applications. A list is also given of the industries being served with the coating.

Carbon and Graphite for Chemical Applications

National Carbon Co., Dept. MF, 535 Fifth Ave., New York 17, N. Y.

A 4-page illustrated bulletin, catalog section 5-5008, discusses each of a wide range of products, and refers to specific catalog sections that contain complete technical data.

The equipment described includes shell and tube heat exchangers; cascade, concentric and immersion type heat exchangers; centrifugal pumps; entrainment separators; pipe and fittings; towers and accessories; and brick, structural shapes and cements.

Barrel Finishing Machine

Casalbi Co., Dept. MF, 540 Wayne St., Jackson, Mich.

A leaflet on the RD series, model RD/2 barrel machine for deburring, grinding, burnishing, polishing, etc., gives information on specifications, features and uses of the machine.

Metal Center Buffs

Divine Bros. Co., Dept. MF, Seward Ave., Utica, N. Y.

An 8-page color folder contains specifications on the Red-D-Vent buff, a cross section showing the full construction of the buff, and comparisons between the new metal center buff and other types of buffs.

Metalized Plastics

Planet Plating Co., Inc., Dept. MF, 494 Morgan Ave., B'klyn 22, N. Y.

A four page brochure describes the techniques and applications of the barrel plating process for metalizing plastics. In addition to discussing many of the advantages of metalizing small plastic products, the brochure includes a photographic step-by-step story showing the actual plant process.

Cold Cleaning Solvents

Chlorine Products Section, Electrochemicals Dept., Du Pont Co., Dept. MF, Wilmington 98, Dela.

A new "safety in use" approach for evaluating the relative safety of solvents used in cold cleaning of metal parts is contained in a new technical report.

The report establishes a new concept of a relative safety index for solvent evaluation based on maximum allowable concentration, vapor pressure, and evaporation rate of the solvents.

Tong Test Ammeter

Columbia Elec. Mfg. Co., Dept. MF, 4519 Hamilton Ave., Cleveland 14, Ohio.

A new 8-page catalog on its complete line of tong test AC-DC ammeters has just been released by the above company. The new bulletin pictorially illustrates eight types of instruments and gives detailed information on the selection, ordering and use. There are actual size scale ranges shown to assist in the specification of desired ranges. Special tong tests for low current readings are also pictured and described. Bulletin includes prices and shipping weights as well as information on the low cost of Type AC-1 volt-ammeter and the new Model UV-1 AC-DC voltmeter.

Electrocleaner for Zinc Die Castings

Oakite Products, Inc., Dept. MF, 18 Rector St., New York 6, N. Y.

Composition No. 195, a new, nonetching reverse current cleaner, is described in a new folder, F 10466, which gives the application procedure recommended for its use.

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

Fifth Industrial Finishing Exposition

Dynamic Detroit — the Automotive Center of the World — will be host to the Fifth Industrial Finishing Exposition, June 15-19, 1959!

The Exposition will be held at the Detroit Artillery Armory during the Golden Jubilee Convention of the American Electroplaters' Society and promises to be the largest and most complete show of its kind ever held. Space sales to date are greater than for any previous exposition and available space is at a premium.

The "open" design of the Exhibit Floor is a new concept for this type of show. Wider aisles permit easy access to all booths and the larger number of island exhibit areas is another innovation.

Because this is the 50th Anniversary of the A.E.S. a theme has been developed to graphically portray the advancement of this industry over that period of time. One Feature Lounge area will illustrate the growth of the Society, its achievements, and the research program constantly being carried on. A second Feature Lounge will have a display built around the history of metal finishing processes, including actual parts produced at various periods. The third Feature Lounge will de-

DEPENDABLE PPI PRODUCTS

PLATING RACKS
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ANODE HOOKS
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PLASTIC COATED DIPPERS & PAILS
STEEL, STAINLESS STEEL TANKS
LEAD & PLASTIC LINED TANKS
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SAVE ON NICKEL USAGE . . . with PPI UZALL ANODE HOOKS . . . .

Uzall Anode Hooks are made of ⅜ in. Square Monel or Nickel plated Steel — then Plastisol coated. These hooks are furnished with rubber anode protectors. Uzall Hooks can be supplied in length sizes from 4 in. thru 8 in.

ADVANTAGES:

- Conserves on nickel usage
- Cuts down on nickel scrap
- Hook can be used over and over again because it is protected by a plastisol coating
- The rubber anode protector protects hook threads from corrosion and current attack

Plain PPI Anode Hooks

Furnished in all sizes 3 in. thru 8 in. (1 in. length increments) Steel — Copper — *Monel

*Monel Hooks subject to availability of material

Prices Quoted Upon Request

PLATING PRODUCTS, Inc.

1509 N. WASHINGTON
KOKOMO, INDIANA

Howard John McAleer

velop the history of equipment used in the industry — displaying some of the old equipment that was used, as well as the modern type now in use.

Evening show hours will be maintained to make it possible for as many interested persons as possible to attend this Exposition.

Howard John McAleer, chairman of the 1959 AES Industrial Finishing Exposition, was born in Pittsburgh, Pa. in 1915. He is president of Formax Manufacturing Corp., Detroit, and has been a member of AES for nearly 20 years. He is a member of the Engineering Society of Detroit; a past president of Detroit Branch, AES; former member of Plating's Editorial Board.

New York Branch

The New York branch, which celebrates its fiftieth anniversary in 1959, will hold its annual Educational Session and Banquet on February 7, 1959 at the Hotel Statler in New York City.

A committee headed by *Joseph Rembecki* is planning a golden anniversary program to commemorate the event, which will include an expertly planned technical session and an unusually fine banquet and floor show.

Educational chairman *Arthur Carlson* has arranged the technical session. Topics for the afternoon educational program are:

"Copper-Nickel-Chromium Exposure Tests on Steel" by Walter Pinner, Manager, Electroplating Development, McGean Chemical Co., Cleveland, Ohio.

"Nickel Plating for the Last Fifty Years" by Dr. D. G. Foulke, Head of Research, Hanson - Van Winkle - Munning Co., Matawan, N. J.

"Corrosion Studies with Various Combinations of Nickel and Chromium Plate" by Dr. Henry Brown, Head of Research, Udylite Corp., Detroit, Mich.

Reservations for this gala event may be obtained by writing to *Angelo Amatore*, 9226 Foster Ave., Brooklyn 36, N. Y.

Grand Rapids Branch

October 11 was the occasion for the happily anticipated Annual Ladies Night. Seventy-two members brought their wives to the Louis XIV Room of the Manger Rowe Hotel for the gala occasion. The gals were treated to cocktails, a fine smorgasbord dinner, dancing, and a wonderful social evening. Following dinner, Committee Chairman *Dick Watson* conducted the raffle of beautiful door prizes contributed by twenty-four generous vendors in the Grand Rapids area. Third National Vice-President *"Honest" Chet Borlet* was unanimously approved to draw names while committee members *Don Smith, Carl Byrns* and *Tom Henner* distributed the prizes to the delighted wives. The dancing that followed was interrupted only by opportunities to renew old friendships.

General Chairman *Donald Smith* announced that plans have been completed for the Grand Rapids Branch Annual Educational Session and Banquet to be held on January 17, 1959. Educational Chairman *Orville Hoxie* has arranged a comprehensive program consisting of discussion of Hi-Speed Copper Plating by *Barnet Ostrow* of Lea-Ronal, Waterbury, Conn., beginning at 10:30 a.m. Luncheon will be served at noon and followed by a talk entitled, "Scientific Aids in Crime Detection" by *Karl Kempe* of the Grand Rapids Police Crime Laboratory. The banquet will be held in the Pantlind Hotel Ballroom at 7:00 p.m. Reservations will be accepted by *John Dykstra* after December 1. Other members of the committee are: entertainment, *Robert Blackford;* publicity, *Thomas Henner;* programs, *Edwin Krook;* and favors, *William Griffin.*

The Grand Rapids Branch would like to extend a cordial invitation to members and guests from all other branches to attend.

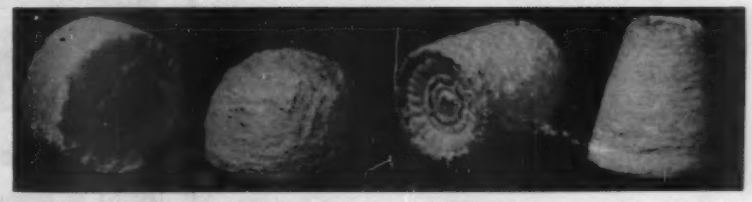
Thomas C. Henner
Second Vice-President

Baltimore-Washington Branch

The branch held its opening meeting of the 1958-1959 season on Thursday, October 16, at the National Bureau of Standards in Washington, D. C. The meeting was a joint meeting with the Baltimore-Washington Branch of *The Electrochemical Society.* The latter held a brief business meeting preceeding the featured speaker and the former held their business meeting following the speaker.

Dr. Abner Brenner of the National Bureau of Standards lectured on his recent visit to Moscow. In May 1958, Dr. Brenner attended a conference on corrosion and protection of metals which was held under the auspices of the USSR Council of Scientific and Engineering Societies. Dr. Brenner re-

BUFFS FOR INSIDE POLISHING



GOBLET BUFFS, TAPER BUFFS, CYLINDER BUFFS, SMALL POLISHING WHEELS. RAZOR EDGE BUFFS, and many others for deburring, polishing and grinding any internal contour.

Write for additional information or contact your local dealer. These buffs are stocked by many dealers throughout the country.

We manufacture a COMPLETE LINE OF BUFFS including full disc loose and sewed buffs and polishing wheels. Our metal center BIAS TYPE BUFF may help cut your polishing costs.

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ported on the conference and also gave his personal impressions of Moscow and the Russian people. Approximately fifty minutes were devoted to the showing of three dimensional colored slides. Following Dr. Brenner's talk concerning his delightful experiences in Moscow, he showed colored slides he had taken on his return trip to this country. These slides included Copenhagen, Berlin, Rome, Geneva, Luzerne, the Jungfrau in the Bernese Oberland and the World's Fair at Brussels.

John F. Kreml, research engineer, Armco Steel Corp., Baltimore, Md. was elected to membership. *Harold W. Scott* and *Edward J. Roach* were elected as alternate delegates for the 1958-1959 season.

Harold W. Scott
Secretary

Columbus Branch

The regular monthly meeting was held at Battelle Memorial Institute on Friday, October 3, at 8:00 p.m. The business meeting was called to order by President *Harry Moore*, and candidate *Clade Tuttle* was duly approved and elected as a member of the branch. The branch voted that it is in favor of an exhibit at the national convention but think it is a poor year to start it, the opinion was that it should be put off until 1960.

Librarian *Les McGraw* introduced the speaker of the evening, *James Hesler* of Industrial Filter and Pump Mfg. Co., whose subject was "Handling Plating Room Wastes." Mr. Hesler gave a very interesting talk on waste plant theory and design.

Following a question and answer session, and a round of applause for the speaker, the meeting was adjourned.

Halvor Christianson

Blue Ridge Branch

The branch held its regular monthly meeting Oct. 3, at 6:30 p.m. at the Hut restaurant near Martinsville, Va. *T. R. Boggess* presiding.

Mrs. Betty Browder of Bassick-Sack and *Lathan C. Jackson* of Sperry Farragut were elected to membership.

C. G. Haupt, chemist for the Norfolk and Western Railway, gave a continuation of his program of last June. A lecture-demonstration on pH was conducted. Highlights were the factors of pH in our everyday life and other processes besides plating. The use and care of pH meters was demonstrated and tips on better care were given and explained.

Carl A. Witherspoon
Secretary-Treasurer

Indianapolis Branch

Forty-eight members and guests met on Oct. 6 for a real Hoosier dinner in the heart of Hoosierdom at Abe Martin Lodge in Brown County State Park. This was the yearly meeting of the branch as guests of the Columbus, Ind., members.

After the usual introductions, a short business meeting was held. Two new members, *Ralph M. Branagan* and *Thomas C. O'Nan*, were received by vote of acclamation. A motion by *John Holland*, amended by *Dr. A. Max* and seconded by *Les Reynolds* placed the question of a branch exhibit at the A.E.S. Convention in 1959 in the hands of the officers and board of managers. The motion was carried.

A moment of silence was observed at the request of *Bert Hawhee* for re-

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Nuglu, a liquid glue, developed to lengthen wheel life — produce a better finish, and increase metal finishing production.

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A mixture of Nuglu and graded aluminum oxide grain —

Save on operating costs, increase production, reduce wheel inventories, and obtain greater results, with less costly materials, in fine polishing work!

Ask for information on The Siefen Finishing Systems — Also for better metal finishing use Siefen Compositions • Stainless Steel • Bar (Grease) in Tube • Liquid Tripoli • Liquid Grease • Lapping Compound • Burring Compound.

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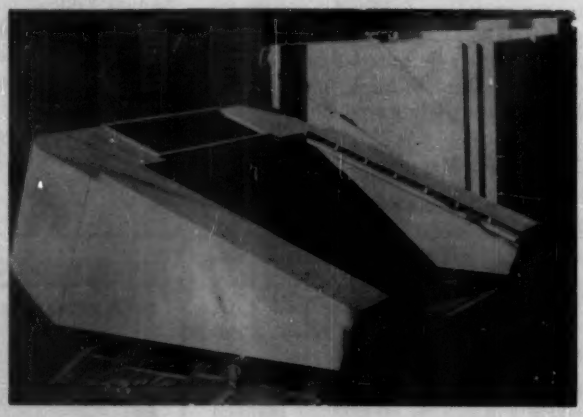

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INSIST on getting the best of design and construction in your exhaust hoods. In the long run they cost less and do your job better. Investigate how STORTS exhaust hood design protects you against rapid deterioration in service and makes it easy to keep your hoods in condition — how STORTS welding procedures develop top strength — how built-in stamina outlasts your expectations.

STORTS WELDING COMPANY INCORPORATED
38 Stone Street
MERIDEN, CONN.

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cently departed member *Marvin Steurenagel.* The meeting was then adjourned to enable the members and guests to watch an exhibition of square dancing and then to participate in the dancing. It was a very enjoyable evening.

A short meeting of the board of managers and officers was held after the business meeting to decide upon the matter of a branch exhibit at the 1959 Convention. The delegates were instructed to vote that the branch would not exhibit.

A. M. Howard
Secretary

Buffalo Branch

The branch held its October meeting at the Moonbrook Country Club in Jamestown, N. Y., on Friday, the third. After a delightful dinner and business session, *John Donaldson,* librarian, introduced *Dr. Ivor E. Campbell* of Battelle Memorial Institute who spoke on the "Formation of Coatings of and for Refractory Metals."

The annual Christmas Party will be held Saturday, December 20, 1958 at the Niagara Manor, 899 Niagara Falls Blvd., Buffalo, N. Y. *Roger Brown* is chairman of the Christmas Party Committee and will be assisted by *Fred Goeckel* and *Roy Laciura.*

The January meeting will be held the 2nd Friday of the month instead of the usual first Friday. Our librarian is planning to hold another down-to-earth discussion on plating problems, techniques and developments which will be spearheaded by various members of the branch. A similar meeting held last season proved highly successful.

The 5th Empire State Regional Meeting will be held April 11, 1959 at the Hotel Stuyvesant in Buffalo, N. Y.

Robert E. Lienert
Secretary

Los Angeles Branch

Edward R. Wadleigh, sales engineer of the deionizer equipment division of Carma Mfg. Co., Torrance, Calif., brought members of Los Angeles Branch up to date on problems and developments concerning chemical treatment of water in plating shops in a talk presented at the branch's October 8 meeting in Rodger Young Auditorium, Los Angeles.

In line with Supreme Society policy that requires branches to designate convention delegates earlier than in past years, Los Angeles Branch chose three delegates and three alternates at the October 8 meeting to represent it at the 1959 Detroit convention. Named as delegates were *Norman McEwan, Emmett T. Babcock* and *George J. Hetz;* and as alternates, *G. Stewart Krentel, Mitchell Raskin* and *Earl Arnold.*

Membership Chairman Hetz called for a more vigorous membership drive. He reported that branch membership as of March 31 stood at 314, but that a long list of delinquents, on which action must soon be taken, may reduce the roll to below 250.

Harold Zagorian of Bumper & Auto Plating Co. was initiated into membership. Applications were accepted from *Charles Donelli* of Western Chemical Co. and *J. Schneider* of Wyandotte Chemical Co.

Mr. Raskin announced that a new night school course for platers is now in its fall term at Woodbury College, Los Angeles. The course began in September and will continue through Jan-

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uary, 1959. The course includes instruction in practical electroplating and a special course in plating of printed circuits. Raskin serves as the instructor. He reported that, while maximum registration for the Fall course has been attained, popular demand has caused the sponsors to hold a second semester of the same course, beginning February 1. Class capacity is 65 students.

Chicago Branch

The regular meeting was held at the Western Society of Engineers on Friday, Oct. 3, at 8:00 p.m. Seven new memberships were accepted to the branch. The guest speaker for the evening was *Ron Dow*, manager, technical service of Metal and Thermit Corp., who spoke on "Recent Developments in Chromium Plating." A lively question and answer period followed and he was warmly thanked for his very informative talk.

Christopher Marzano
Publicity Chairman

Detroit Branch

Preceding the monthy meeting on October 3, *Manuel Ben*, President of the Branch, called an executive group meeting. *Ed Kubis*, secretary-treasurer, reported that all delinquent members had been suspended and that notices had been sent to each member stating that these suspended members would be reinstated with payment of their dues.

Don Bigge reported that the chapter handbook would be out by November 1st and that one copy would be sent to each member of the branch. There would be a supply of these books available for purchase at 50c each. *Fred Olmstead* reported on research procedures and problems and asked for the help of all members in selling sustaining memberships. It is suggested that any members having any suggestions for the promotion of such sales contact Mr. Olmstead.

Carl Durbin reported on the December party stating that the letters to members would go out immediately and with each letter would be a requisition covering two tickets which the member can sign and send back with his check to secure his two tickets. This is the only means of distribution of the tickets with the exception of the few that will go to members outside of the branch and dignitaries. *John Siefen* reported on the successful handling of the Stag Day Party and the resulting small profit.

The branch meeting was attended by approximately 150. *Myron Perez*, of Metal and Thermit, spoke on the subject of "Organic Coatings over Plated Surfaces." Following the meeting, refreshments were served.

Robert C. Trees
Publicity Chairman

Rochester Branch

The October meeting at the Rochester German Club was called to order by President *Frank Beuckman*. Business matters discussed were as follows: Approved sending $10.00 to A.E.S. Research Fund in the name of *William Fotheringham* of the Buffalo Branch who has befriended the Rochester Branch on many occasions and will be greatly missed by both branches. Approved suspending all members who have not paid dues by the 15th of October.

The speaker of the evening was introduced by Librarian *Ed Penczek*. *T. Mendell*, chief electrical engineer at Rapid Electric Co., gave an extremely interesting talk on rectifiers, their "in-

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nards" and their "outards." The various kinds of materials used in building rectifiers were discussed as well as types of controllers, ripple phenomena, etc. His talk and question-answering period well rewarded those members who came to this meeting.

Linwood P. Morrison
Secretary-Treasurer

Newark Branch

The first Organic Finishing meeting of the branch was held on October 24th with 65 present. In the business meeting *Don Volino* was welcomed back to Newark, transferred from Philadelphia. Elected to membership were: *Theodore Barreiro* of Howard Corp., *Francis Carlin* of International Nickel, *John Cota*, *Andrew Chasmer* and *Charles Tringali* of S. Blickman, *Joseph Connel* of Wigder Mfg. Co., and *Frank Kelly* of Kelite Corp. Four applications were received and referred to the board of managers.

Don Foulke announced the Philadelphia annual meeting and reported two job opportunities. *Gus Bittrich* congratulated *John Kosmos*, chairman of the By-Laws Committee and announced that copies of the executive committee-approved by-laws were available for study and would be voted upon at the November meeting. *Fred Meyer* reported that the Christmas Party was well organized and asked that the Boosters reply promptly. *Cy LaManna* stated the Electroplating School was about ready to move into action and that only a few openings remained for registrants.

Mr. Bittrich announced the award to the branch member giving the best Timely Topic during the year had been designated the *Louis Donroe* award. Dr. Foulke then spoke on the New Jersey water referendum and moved support.

George Wagner reported the bank balance as greater than it was at the end of the year and stated that support of the Christmas Party was needed to guarantee a successful year. George also pointed out that some of the early Newark members were present — *Ed Faint*, *Sam Taylor* and *Dave Clarin*, now a New York Branch member.

The meeting was then turned over to Librarian *Al Korbelak* who introduced *E. LeRoy Gabel* of Allied Research Products, Inc., who discussed the use of the water soluble resin coating, Irilac, in which is incorporated corrosion inhibitors. A number of slides were shown and it was explained that the concentration of the coating was maintained by a hexavalent chromium determination.

Mr. Neidhammer of DeVilbiss Co. then discussed "Hot Catalytic and Automatic Spray Painting." Types of equipment were described and various spray guns discussed and exhibited, including the steam spray gun, the catalyst gun.

D. Gardner Foulke
Secretary

Southeastern Branch

In conjunction with the Golden Jubilee observances, the Southeastern Branch will be host for the "First Dixie Regional Technical Educational Session" to be held February 13-14 at the Dinkler-Plaza Hotel, Atlanta, Ga. The Sixth Interim meeting of the A.E.S. will be held at the same time and place, with the executive board of the Supreme Society in session.

The two-day meeting will include a

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plant tour, two educational sessions and the annual mid-Winter meeting of the Supreme Society. A reception and banquet Saturday evening, February 14, will conclude the festivities.

George W. Asher
Publicity Chairman

Left to right, seated, BOB M. TAYLOR, Southeastern Branch 1st vice president; CLAUDE J. NALLEY, Southeastern president; MYRON M. RANDMAN, committee general chairman; HERSCHEL R. STOGNER, SR., Branch and committee secretary-treasurer. Standing, JOHN E. VARNER, program chairman; MRS. MYRON M. RANDMAN, ladies program; GEORGE W. TAYLOR, board of managers Southeastern Branch; MRS. CHARLES I. LEWIS, ladies program; WILLIAM F. KELLY, publicity chairman; MRS. WILLIAM F. KELLY, ladies program; CHARLES I. LEWIS, plant visitation chairman and Southeastern board of managers; CLYDE STOVALL, Southeastern board of managers; FRED FULFORTH, Sixth Interim Meeting coordinator. Committee members not present, JUSTUS U. BELLEVILLE, entertainment chairman; RICHARD R. RUSSELL, registration chairman and JERITA D. WILSON, educational chairman.

Dayton Branch

The branch held its monthly meeting on Oct. 15 at Globe Industries, Inc., 1784 Stanley Ave., Dayton, Ohio. Dinner was served, following which was a technical discussion on "Dalic Brush Plating."

The talk was originally scheduled for *P. H. Brotzman*, Ohio Metachemical, Inc., Cuyahoga Falls, Ohio. However, we were very fortunate in having *H. Dennis Hughes*, the co-developer of the process from Metachemical Processes, Ltd., England, in this country working with Mr. Brotzman, his distributor. Since most of the Dalic process at present is being done in England and France, Mr. Hughes talked on some of the applications and uses for the process in those countries. A demonstration of the process was given by by Messrs. Hughes and Brotzman. Refreshments followed the meeting and were furnished by Globe and their engineer, *Larry Hadlock*.

Richard H. Wolf
Publicity Chairman

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New York Branch

Dr. Edward Saubestre, president, presided over the closed meeting at which all the officers were present, on Oct. 10 at the Statler Hotel. On behalf of the Branch he bestowed on *John Trumbour,* business manager of METAL FINISHING, an honorary membership. John has been an untiring and outstanding servant to the New York Branch for many, many years. His achievements are overshadowed only by his modesty. When asked to say a few words after receiving this honor and a ring which was presented to him, all John could say was: "I hope I can be nearly as good a member as my father was."

Al Fusco, voicing the recommendations of the executive board, listed the following names for acceptance by the members as delegates to the next convention: *Angelo Amatore, Milton Nadel, Dr. Edward Saubestre.*

These three were unanimously accepted as were the alternates: *Geo. Herrmann, Joseph Rembecki, Arthur Carlson.*

There being no other business, the chair was turned over to Librarian Carlson to conduct good and welfare.

Artie's choice for the night was Mr. Weisberg of Technic, Inc., who discoursed on precious metal plating. Injecting some humor in his talk, Mr. Weisberg covered his subject quite well. He emphasized the lack of tolerance in "flash" solutions, which he referred to as starved solutions. The enthusiasm of the discussion session which followed was evidence that Mr. Weisberg had satisfied his listeners. He then received a rising vote of thanks after which the meeting was adjourned.

Highlighting the meeting of September 26, 1958 was the re-nomination by the N. Y. Branch of Mr. Carlson and Dr. Weisberg for the "Scientific Achievement Award."

Anthony P. Briganti
Recording Secretary

British Columbia Branch

The meeting of October 20, at Canadian Pacific Airlines, Vancouver Airport, was a special one to which the ladies were invited. There were 41 members and guests present. This was a special meeting because of three different factors. First of all, it acknowledged the British Columbia Centennial Year. Second, it was planned as branch recognition of the Golden Anniversary of the A.E.S. and, last, but certainly not least, the ladies were invited to attend.

After the refreshments, the regular meeting continued. Four new members were elected: *Hans Mroch, Jeno Hofbauer, Hugo Eppich* and *Walter Marshall.*

Walter Kellerman gave the following report concerning the electroplating night school course. The attendance so far has not met the requirement of 15 pupils. Few of those who have come out are engaged in the electroplating industry. Unless a guaranteed 12 people turned out within the next couple of evenings, Walter felt that it would be necessary to discontinue the course. He felt also that the people who have attended should be asked to join this branch of the A.E.S. *Gordon Smith* volunteered to attend the next evening of night school and to talk to these people with this point in mind.

It was also agreed that all members should, by telephone or direct contact, endeavour to enroll immediately a few

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more pupils, in order to maintain the night school course this year.

The next item on the agenda was a discussion of the action that should be taken regarding members who have not as yet paid their dues after two notifications. It was decided that Gordon Smith and the secretary should contact these delinquent members by telephone and attempt to finalize this problem.

It was decided that the next meeting should be held at the White Spot Dining Room, 25th and Cambie Sts., on Wednesday, November 19th, and that the meal charge should be $1.00.

The meeting was adjourned at 10:25 p.m.

N. A. Shepherd
Secretary

San Francisco Branch

Jack Hite, president, called the meeting of October 9 to order at 8:30 p.m. *Fred Huntington* introduced the speaker, *Leo Missel*, who spoke on "Coatings For The Missile Industry." Mr. Missel discussed the various types of coatings that are now being used and pointed out the emphasis that must be placed on precision and quality plating and electroforming. He also pointed out the growing importance of beryllium in this field.

The regular business session followed and *Guy Condrett* reported that thirty-three members and twelve guests were in attendance, the best turnout so far this year. As chairman of the membership committee, Guy also announced that four new applications for membership had been received: *John T. Hatcher, Frank B. Axelrod, Jerry E. Adams*, and *Richard L. Mitchem*.

Trevor Harry, librarian, announced that *Eugene Bosl* of Alert, would be the speaker at the November meeting. *Fred Huntington* reported on plans for the annual banquet. By vote it was agreed to hold the banquet at Goman's Gay Nineties on November 22nd.

The following were elected as delegates to the National Convention: *Dominick Naviglia, Guy Condrett, Jack Esposito.*

The following were elected as alternates: *Al Lee, Fred Huntington.*

Al Lee
Secretary-Treasurer

THE ELECTROCHEMICAL SOCIETY

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Dr. William Blum

was presented the newly-established Electrochemical Award of its Washington-Baltimore Section at an award dinner on the evening of November 20. At the same time, the section announced that this semi-annual award in recognition of outstanding contributions to electrochemistry would be named the "William Blum Award" in honor of its first recipient.

Dr. Gwendolyn Wood, chairman of the Washington - Baltimore Section,

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made the presentation which consisted of a check for one hundred dollars and a certificate which cited the recipient for "fundamental contributions to the science of electrochemistry, with special reference to the techniques and theories of electroplating."

NEW BOOKS

Transactions Institute Metal Finishing

*Published by Institute of Metal Finishing, 32 Great Ormond St., London W.C.*1, 1958. 493 *pages, including index. Price: Three Guineas to non-members.*

Volume 34 contains the papers presented during the 1956-7 period, on various phases of metal finishing. The 29 papers cover both metal coatings and organic finishes and maintain the reputation of the Institute for articles of a high degree of excellence, not excluding some very intelligent discussions following many of them.

Some of the subjects detailed are alloy baths, chromium plating of gun barrels, leveling, barrel and centrifugal lacquering, anodizing, bright tin, adhesion of deposits, airless and aerosol spraying of organic coatings, measurement of stress, and automatic control in the electroplating industry. A number of theoretical treatments will also be found in the present volume.

Electrodeposited Metallic Coatings

Published by American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. 1958. 124 pages. Price: $2.25.

This compilation of ASTM standards covers such materials as electrodeposited zinc, cadmium, nickel, chromium, and lead for steel. In addition, coatings for copper, copper base alloys, zinc and zinc base alloys are also covered. This 1958 edition supersedes the previous issue in 1955.

Local thickness acetic acid, and salt spray tests are included in this volume. To make the book more complete and of greater use to industry and government, recommended practices for preparing metals for plating are included. These include plating for low carbon steel, high carbon steel, aluminum alloys, zinc base die castings, iron castings, etc.

In all, the book contains seven specifications, three methods of test and nine recommended practices. Of the total 19 standards, five are new, recently revised or have had their status changed within the year.

Paint Finishing in Industry

Published by Robert Draper Ltd., Kerbihan House, 85 Udney Park Road, Teddington, Middlesex, England (1958). 488 pages, including index. Price: 84 s ($12.00).

This well-illustrated book deals, in the main, with paint application methods currently in widespread industrial use. Other items covered are: materials of and procedures for testing organic coatings; surface preparations; paint shop troubles and their corrections. An entire section is devoted to the coating of specific items, such as automobiles, refrigerators, and castings. A list of government and so-

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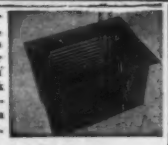

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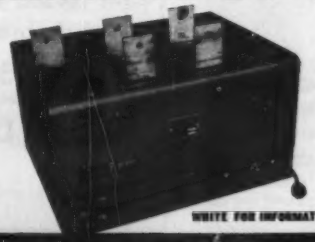

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ciety specifications covering those in England, United States, India, and Canada are included.

The book primarily concerns itself with the broader field of organic finishing. Except for the chapters covering convection and radiant [stoving] baking equipment, only the more salient points of finishing techniques and equipment are described.

Paint Finishing in Industry readily lends itself to becoming a valuable and expedient text and/or reference book for all those engaged in the paint application, testing, and manufacturing fields.

News from California

By Fred A. Herr

Officers of the newly charted Southern California Chapter of the National Association of Metal Finishers, who were elected at a recent meeting in Rodger Young Auditorium, Los Angeles, are as follows:

President, *Walter P. Behlendorf*, Spence Electroplating Co., Los Angeles.

First Vice-president, *Harold Coombs, Jr.*, Crown City Plating Co., El Monte, Calif.

Second Vice-president, *Jack Montgomery*, Modern Plating Co., Inglewood.

Third Vice-president, *Whitney Lundt*, Cadmium & Nickel Plating Co., Los Angeles.

Treasurer, *Paul Koeickritz*, Los Angeles Parkerizing Co.

Clyde Cameron has been engaged as executive secretary.

Behlendorf reported that the chapter has held two monthly meetings since the organziational meeting in June and that membership has increased from the charter group of 15 to 20. Meeting will be held the third Wednesday of each month at Rodger Young Auditorium, and are not in conflict with Los Angeles Branch, A.E.S. which meet the second Wednesday of each month. Meeting programs are geared to the executive and management level, Behlendorf reported, such as wage rates, credit problems, and management and financial matters. *Bert Sherwood* of the Chem-Plate Co. has been named program chairman.

Carma Mfg. Co. of Torrance, Calif., has construction underway on a new plant in Tucson, Ariz., which will be equipped for the manufacture of water conditioning and deionizing equipment. *C. E. Gagnier*, president, who makes his headquarters in Tucson, will manage the new Arizona plant.

The company has been active in the manufacture of electronic mechanical devices for aircraft for several years. It recently added a new department to its Torrance facilities for production of water conditioning equipment for plating shops, in the development of which *Edward E. Wadleigh* of the home office staff played a leading role. The new Arizona plant was erected to facilitate manufacture and service of deionizing systems in the southwestern area of the United States.

Mitchell "Mike" Raskin, who has served as plating instructor in night school classes held in the Los Angeles area for nearly a dozen years, reports that he now heads a new class in a new location.

Woodbury College, located on Wilshire Blvd., in the near down-town district of Los Angeles, has engaged Raskin to teach a two semester class in which the courses consist of instruction in the basic principles of electroplating as well as a special class concerned with plating printed circuits.

Raskin's background in the practical phases of electroplating as well as management and research phases, qualifies him well for the instructorship. Now serving as a plating consultant with headquarters at 3034 Greenfield Ave., West Los Angeles, Raskin previously was active as general manager of Commercial Plating Co., Los Angeles, factory manager for Ajax Hardware Co.,

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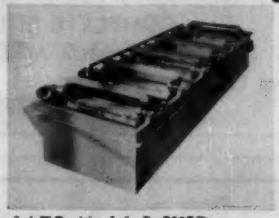

LAZO Model 2-SHSD . . .
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Size: Overall: 206"x63"x39" high
Tank: 202"x51"x30" high
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All Plating Solutions
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factory manager for Globe Lighting Fixture Co., and process engineer for Northrop Aircraft. The second semester of the Woodbury College plating course will begin in February, 1959.

The Plant Hold Corp. of South Gate, Calif., has completed installation on a new conveyorized finishing system with which bare metal is degreased and enamel finish parts are baked in a single infra-red oven.

The firm produces equipment for vertical filing of maps and blueprints. Fabricated parts and assemblies are fed onto an overhead monorail chain conveyor which operates at a constant speed of 1.5 feet per minute. The arrangement carries the parts first through the oven for degreasing, then through a spray booth for painting and, finally, through the oven for a second baking. Pieces in either stage of finishing, it is reported, can be intermixed on the conveyor, since a common time and temperature cycle is used for both degreasing and baking. The operation requires about one hour and ten minutes to complete a so-called loop of the conveyor system.

Supplementing the installation of a third new high-speed electrolytic tinning line at its Pittsburgh, Calif., plant, United States Steel Corp. has announced the letting of contracts for a new continuous annealing line. The project includes a 216 foot addition to the existing annealing building at Pittsburgh and will have the height of a nine story building.

George Warmald, manager of industrial auto finishes at the Chestnut Run Plant of the DuPont Company, delivered a talk on "New Monastral Reds" at the October 8 meeting of the Los Angeles Paint & Varnish Production Club.

Mr. Warmald first reviewed the generally-used pigments and their properties. In covering the various points of his talk, Mr. Warmald used an assortment of slides. He showed ladders of blends with titanium dioxide and aluminum in both baked enamel, air dry enamel, and emulsion finishes. Examples also were given for heat resistance, showing panels baked for 30 minutes at 275°F. vs. 10 minutes at 375°F., and air dried. The speaker stated that Monastrel colors will withstand up to 700°F.

An award for 75 years of service as the oldest distributor for the Norton Co., was recently presented to *C. W. Marwedel*, San Francisco's oldest industrial tool and supply firm, whose headquarters are at 1235 Mission St., San Francisco.

Marwedel, now a subsidiary of the Garrett Corp., began representing Norton and its line of industrial grinding wheels and abrasives in 1882. Norton executives present for the presentation of the award were *Ralph E. Gow*, executive vice-president; *John Jeppson*, vice-president and general manager of the abrasives division; *Don L. Price*, manager of the grinding wheels division and *W. M. McCune*, manager of field sales.

S. G. Thornbury, president, Turco Products, Inc., Los Angeles, has announced plans for construction of a new national headquarters center in Wilmington, Calif. The project calls for an administration building, executive wing, a research division and an engineering service building. Cost is estimated at $1,000,000 for the 66,000 square feet of new buildings.

OBITUARY

ROBERT W. NELSON

Robert Wallace Nelson, 48, vice president of *American Air Filter Co.*, died suddenly October 9 while at work. Mr. Nelson was a former president of the Air Moving and Conditioning Assn. and a member of the American Society of Heating and Air Conditioning Engineers.

A native of Moline, Ill., he was graduated from Culver (Ind.) Military Academy and attended the University of Illinois and University of Pennsylvania, where he was a member of Delta Tau Delta Fraternity.

In 1939 he joined the Herman Nelson Corp. in Moline and was a vice-president when it merged in 1950 with American Air Filter. With AAF he was executive assistant to the director of sales until 1956 when he became director of the company's central administrative staff.

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ABSTRACTS

(*Continued from page* 75)

Chemical Post-Treatments for Tinplate

By E. S. Hedges: (Paper read at International Tin Research Congress, Hannover, Germany.)

Research conducted by the Tin Research Institute established that, with a treatment temperature of 90°-95°C. and with a certain concentration of caustic soda, sodium chromate and a wetting agent, a treatment time of 3-5 seconds is sufficient to produce an oxide film which will completely prevent black-spotting of cans. This development work served to show that the former solutions were unnecessarily complicated and that it was possible to work without sodium phosphate. The optimum treatment solution was found to be 3 g./l. sodium chromate and 10 g./l. of a wetting agent.

The treatment does not affect, in any way, the high brilliance of the tinplate surface. The coating film is quite invisible, consequently, tests are important to ensure that the treatment has actually been effectively applied.

It has been found that with hot-dip and electrotinned sheet, a post-treatment can be given both to the cans and also to the sheet. In general, a better result is achieved if the finished cans are treated. With hot-dip tinplate a complete corrosion resistance characteristic against sulfide spotting cannot be quite attained, if the sheet is not two days old before treatment.

The thickness of the oxide film influences the adhesion of lacquer, inasmuch as a thick film, which is formed by a long duration treatment, affects the adhesion while the adhesion is improved by a chemical post-treatment procedure of short duration.

Whether this is a special characteristic of a thin oxide film or a result of the cleaning effect of the alkaline solution used, is not yet clear.

Passivity and Passivating Metal Surface Cover Coatings

By Prof. K. Huber.

Metals can be passivated by purely chemical means and also by electrochemical means. In principle however, the same procedure is involved in both cases. For investigational researches, anodic oxidation by the electrochemical process is more suitable. The author dealt prominently with tests and details with the latter. The electron microscope was also utilized in the investigations and this makes recognizable the structures of the surface characteristics.

The author also dealt, in a comprehensive manner, with the various individual aspects of passivation. It can no longer be doubted today that the passivity of metals is caused by coating. The passivating cover coatings can differ contrastingly from one another in numerous ways. In view of the manifold forms of such coatings, it is understandable that passivity does not always signify the same thing, and this even with the same metal. The occurrance of characteristic and regular pore structure with passivation pheomena is a state which has been noted. It was finally stated that much more and detailed work is necessary, before a complete picture on passivating cover coatings and, accordingly, on passivation itself, is obtained.

Corrosion Behavior Testing on Tinplate

By W. E. Hoare: (Paper read at the International Tin Research Congress, Hannover, Germany.)

Too great a number of factors are involved to enable the overall corrosion behaviour to be measured by any one test process. With the pickle lag test, there is measured the speed of attack of 6 N. hydrochloric acid at 90°C. on untinned or de-tinned steel sheet, either by determination of the loss in weight or else by measuring the rate of hydrogen generation. Steels which are suitable usually show a uniform attack. With steels from which a bad behaviour can be expected, the rate of attack is very low at first. The length of this time is termed the pickle lag.

The hydrogen rate test was developed by the Tin Research Institute to give a comparative indication of the corrosion behaviour of the tinplate with a standard test piece. With this test, the hydrogen generation and the electrode potential during the attack of hydrochloric acid on the tinplate are measured simultaneously. With this test, values are obtained which depend on the thickness of the tin coating, and the alloy coating, on the pickle lag effect, and on the rate of steel corrosion. The practical further development of this process should lead to an improvement in available existing test methods for tinplate.

INDEX TO VOLUME 56 — METAL FINISHING

JANUARY-DECEMBER, 1958

(Compiled by N. Hall, Technical Editor, and I. Oquendo, Equipment and News Editor)

In this index all material that appeared in the January through December 1958 issues of *Metal Finishing* is listed according to subject matter, with cross references where required. Following each listing will be found a letter indicating the manner in which the material was published, as follows:

(S)—Shop Problem
(M)—Manufacturers' Literature
(R)—Recent Development
(B)—Book
(P)—Patent
(L)—Letter to the Editor
(A)—Abstract from Foreign Literature

Any reference not followed by a letter was a feature article. The numbers in the right-hand column refer to the month and page numbers; **6-85** means June issue, page 85, etc.

ABRASIVES, BELTS—See Polishing

ACID DIPPING—See Bright Dipping and Pickling

ADHESION

Flow Coated Paint Film (S) 9- 75
Plating Adhesion Tester (P) 12- 73

AGITATION AND MIXING

Agitating Equipment (M) 8- 93

ALLOY PLATING

Electroplating 22 Karat Gold-Silver Alloy 1- 55
Bright Brass Bath (R) 1- 83
Brass Tarnish (S) 2- 75
Tungsten Plating (S) 2- 76
Hot Dip Aluminum (P) 2- 83
Tin-Copper-Cadmium Bath (P) 3-110
Lead-Tin Alloy Plating from Fluoborate Baths (A) 3- 81
Brass on Bright Nickel (S) 4- 75
Lead-Indium Bearings (S) 5-101
Terne Deposits (S) 5-102
Structure of Nickel-Zinc Plated Alloys (A) 5-110
Brass on Bright Nickel (S) 6- 79
Cadmium-Indium Alloy Bath (P) 6- 81
Bright Brass Bath (P) 6- 85
Plating Nickel-Cobalt Alloy Coatings on Steel (A) 6- 86
Black Chromium (S) 7- 75
Plated Tin-Zinc Alloy Coatings (A) 7- 80
Chromium Alloy Bath (P) 8- 78
Darkening of Lacquered Brass (S) 9- 74
Chromium-Vanadium Bath (P) 9- 77
Antimony-Tin Alloy Bath (P) 10- 79
Deposition of Brazing Alloys (S) 11- 75
Electroless Deposition of Vanadium Alloys (P) 11- 77
Electroless Deposition of Vanadium Alloys (P) 11- 78
Lead-Indium Bath (P) 12- 73
Iron-Zinc Bath (P) 12- 73

ALUMINUM

Firm Adherent Plating for Aluminum 1- 53
Aluminum Oxide Films (P) 1- 71
Conversion Coating for Aluminum (P) 1- 72
Influence of Processing Conditions in Sulfuric Acid on Growth and Characteristics of the Anodic Oxide Coating (A) .. 1- 76
Sealer for Anodized Aluminum (R) 1- 82
Gold-Dyed Aluminum Used in Russian Watches 2- 54
Aluminum Name Plates (S) 2- 75
Plating on Aluminum (S) 2- 76
Aluminum Bright Dip (M) 2-131
Determination of the Coating Thickness of Anodized Films on Aluminum Alloys (A) 3- 82
Aluminum Etchant (R) 3- 88
Aluminum Bath (P) 4- 78
Aluminum Alloy for Bright Finishing (R) 4- 98
Matting Aluminum (P) 5-104
Polytrifluorochloroethylene-Coated Aluminum (P) 5-104
Coloring Anodized Aluminum (P) 5-106
Defective Appearance of Bright Anodized and Heated Surfaces of Aluminum Alloys (P) 5-110
Conversion Coatings for Aluminum (M) .. 5-161
Black Anodizing Aluminum (S) 6- 79
Oxide Coating on Aluminum (P) 6- 80
Behavior of Anodized Aluminum in Contact with Foreign Metals in Marine Climates (A) 6- 87
Aluminum Bright Dip (M) 6-131
Aluminum-Clad Copper Wire (S) 7- 74
Deposition of Aluminum (S) 7- 74
Hot Dipping Aluminum (P) 7- 76
Chemical Oxidation Processes for Aluminum (A) 7- 79
Aluminum Bright Dip (R) 7- 83
Aluminum Cleaner (R) 7- 87
Organic Finishing of Aluminum and Its Alloys 8- 58
De-Smutter for Aluminum (R) 9- 80
Aluminum Finishing (M) 9-119
Hard Aluminum Anodizing (M) 9-119
Aluminum Conversion Coating (P) 10- 79
Anodizing Aluminum Automatically (M) 10-114
Light-Fastness of Organic Dyes on Anodized Aluminum 11- 48
Blistering Around Fine Threaded Holes (S) 11- 76
Rejuvenating Aluminum Pickles (P) 11- 78
Aluminum Test in Bright Dips (R) 11- 90
Polishing and Buffing of Aluminum 12- 44
Plating on Aluminum (S) 12- 71
Coating Aluminum (P) 12- 74
Aluminum Processing (M) 12- 91

ANALYSIS—See Testing

ANODES

Silver Anode (P) 2- 85
Anode Basket (R) 2- 86
Quality Requirements for Nickel Anodes (A) 3- 82
Copper Anodes (M) 3-129
Copper Anode (P) 4- 79
Lead Anode (P) 7- 77
Influence of Chloride Ions on Solubility of Nickel Anodes (A) 8- 89
Platinum Clad Tantalum Anodes (R) 8- 92
Chromium Plating Anode (R) 9- 94
Anode Protection (R) 9- 99
Weldless Anode Baskets (R) 10- 86
Low-Sludge Nickel Anode (R) 12- 82

ANODIZING

Maintaining Chromic Anodizing Bath (S) 1- 65
Aluminum Oxide Films (P) 1- 71
Influence of Processing Conditions in Sulfuric Acid on Growth and Characteristics of the Anodic Oxide Coating (A) .. 1- 76
Sealer for Anodized Aluminum (R) 1- 82
Hard Anodizing-Precision Plating (M) .. 1- 97
Gold-Dyed Aluminum Used in Russian Watches 2- 54
Titanium-Tipped Anodizing Racks 2- 65
Aluminum Name Plates (S) 2- 75
Calculations for Chromic Anodize (S) 3- 76
Determination of the Coating Thickness of Anodized Films on Aluminum Alloys (A) 3- 82
Coloring Anodized Aluminum (P) 5-106
Defective Appearance of Bright Anodized and Heated Surfaces of Aluminum Alloys (A) 5-110
Black Anodizing Aluminum (S) 6- 79
Behavior of Anodized Aluminum in Contact with Foreign Metals in Marine Climates (A) 6- 87
Plating and Anodizing Rack Design 8- 62
Color Anodizing (M) 9-117
Hard Aluminum Anodizing (M) 9-119
Chromic Acid Anodizing (S) 10- 77
Anodizing Aluminum Automatically (M) 10-114
Light-Fastness of Organic Dyes on Anodized Aluminum 11- 48

AUTOMATIC EQUIPMENT

Automatic Barrel Plater (R) 1- 81
Cleaning Table (P) 2- 83
Cleaning Machine (R) 2- 94
Flexibility and Labor Reduction Feature New Plating Department 3- 65
Lucite Barrel for Automatic Plating Machines (R) 3- 84
Loading Arm (R) 3- 88
Automatic - Turntable Barrel Finishing System (R) 3- 95
Automatic Spray Gun (R) 3- 98
Degreasing Machine (P) 4- 78
Automatic Barrel Processing Machine (R) 4- 82
Level Control (R) 4- 96
Automatic Conveyors (M) 4-132
Automatic Coating Spray Unit for Flocking Machines (P) 5-104
Preheating and Dipping Machine (P) 5-104
Dip Coating Machine (P) 5-104
Roller Coating Machine (P) 5-106
Spray Gun Mover for Liquid Buffing Compound (R) 5-112
Monitoring System for Automatic Demineralisers (R) 5-114
Conveyor Type Belt Polisher (R) 5-115
Conveyor Carriers (R) 5-119
Deburring Machines (M) 5-161
Automatic Polisher (R) 6- 88
Paint Stripping System (R) 6- 93
Vertical Conveyor Type Parts Washing Machine (R) 6- 94
Automatic Rack Turnaround (R) 6- 97
Automatic Mask Washer (R) 6-105
Belt Conveying Systems (M) 6-132
Spray Cleaners (M) 6-132
Finishing Systems (M) 6-132
Automatic Spray Equipment (M) 7-108
Conveyors (M) 7-109
Belt Conveyor Systems (M) 7-109
Wire Plating Machine (P) 8- 80
Automatic Chlorinator Control (R) 8- 86
Automatic Polishing Machines (M) 8- 92
Strip Cleaning and Processing Machine (P) 9- 77
Strip Electrotinning (P) 9- 77
Automated Processing Barrel (R) 9- 83
Air Powered Parts Cleaner (R) 9- 89
Parts Washer for Small Batches (R) 9- 92
Complete Process Automation (M) 9-116
Buffing and Polishing Machinery (M) 9-119
Continuous Strip Cleaning (P) 10- 80
Mask Washing Machine (P) 10- 84
Conversion Coating Machine (R) 10- 86
Processing Machines (R) 10- 93
Rotary Conveyor for Polishing Head Units (R) 10- 93
Automatic Dipping Machine (R) 10- 98
Anodizing Aluminum Automatically (M) 10-114
Automatic Painting of Conduit Interiors 11- 63
Use of Automatic Machinery in the Spray Painting Field 11- 68
Plating Machine (P) 11- 78
Polishing Conveyor (R) 11- 92
Full Automatic Conversion Coating Machine (M) 11-113
Automation Painting in Russian Machine Tool Manufacturing 12- 51
Electroplating Apparatus (P) 12- 72
Developments and Trends in Electrotinning Lines for Tinplate Manufacture (A) 12- 75
Mechanical Finishing Machine (R) 12- 79
Automatic Plating Machine (R) 12- 81
Automate Spray Gun (R) 12- 82
Automatic Spray Painting Machine (R) 12- 83
Multi-Process Automation (R) 12- 88
Plating and Processing Machine (M) 12- 91

BAKING AND DRYING

Two Chamber Oven (R) 2- 96
Compressed Air Dryers (M) 3-123
Infrared Oven Sections (R) 3- 97
Production Ovens (M) 3-121
Finishing Systems (M) 4-132
Centrifugal Machinery (M) 6-132
Ovens, Dryers, and Heaters (M) 7-107
Industrial Ovens (R) 8- 89
Infra-Red Test Kit (R) 9- 91
Infra-Red Oven Sections (M) 9-118
Dehumidification (M) 9-119

BARREL FINISHING—See Tumbling

BARREL PLATING

Automatic Barrel Plater (R) 1- 81
Belt-Driven Plating Barrel (M) 1-115
Plating Barrels (M) 1-115
Barrel Chromium Plating Continuous Bulk Processing 2- 58
Brass Tarnish (S) 2- 75
Lucite Barrel for Automatic Plating Machines (R) 3- 84
Laminated Nickel Deposits (S) 4- 75
Automatic Barrel Processing Machine (R) 4- 82
Automatic Conveyors (M) 4-132
Ductile Barrel Nickel (S) 5-102
Practical Aspects of Barrel Plating (A) 5-110
Cogged V-Belt Drive Plating Barrel (R) 5-112
Combination Tumbling - Plating Barrel (R) 5-118
Stained Cadmium Plate (S) 6- 78
Rack-mounted Plating Barrel (R) 6-103
Automated Processing Barrel (R) 9- 83
Barrel Plating Equipment (M) 9-117
Bolted Plating Cylinder (R) 10- 87
Plating Barrel (M) 11-113

BLAST CLEANING

Sandblast Machines (M) 1-115
Liquid Abrasive Blasting Machine (R) 3- 95
How Grit Blasting Improves Phosphate Coatings 3- 57
Abrasive Blasting Barrel (R) 3- 90
Dispenser for Abrasive Grit (P) 4- 78
Blast Cleaning (M) 4-132
Abrasive Blasting Apparatus (P) 5-103
Blast Cleaning Abrasive (R) 5-128
Liquid Abrasive Blasting (P) 6- 84
Sandblasting Tool (P) 7- 78
Wet Blast Applications (M) 10-115
Dry Honer (R) 11- 90
Abrasive Blast Barrel (R) 11- 91
Abrasive Blasting (P) 12- 72

BRASS PLATING—See Alloy Plating

BRIGHT DIPPING

Aluminum Bright Dip (M) 2-131
Chemical Polishing 3- 52
Bright Dipping Zinc (S) 3- 76
Chemical Polishing 4- 62
Protective Bright Dip for Cadmium (R) 4- 85
Chemical Brightening Magnesium (S) 5-102
Aluminum Bright Dip (M) 6-131
Chemical Polishing of V 2 A Stainless Steel by Gases (A) 7- 78
Cadmium Bright Dip (R) 7- 83
Aluminum Bright Dip (R) 7- 83
Bright Dip for Copper and Brass (R) 11- 82
Aluminum Test in Bright Dips (R) 11- 90
Cadmium Plating (S) 12- 70

BRIGHTENERS

Bright Brass Bath (R) 1- 83
Acid Copper Plating Process (R) 1- 84
Addition Agent for Acid Copper Bath (P) 2- 80
Addition Agent for Acid Zinc Bath (P) 2- 80
Bright Gold Bath (P) 2- 80
Bright Gold and Silver Baths (P) 2- 82
Bright Nickel Bath (P) 2- 82
Bright Nickel Bath (P) 2- 83
Gold Bath (P) 2- 84
Acid Copper Addition Agent (R) 2- 86
Bright Cadmium Bath (P) 3- 79
Bright Copper Plating (P) 3- 80
Dispenser Carton for Brighteners (R) 3- 84
Bright Silver Plating (P) 4- 78
Iron Bath (P) 4- 79
Addition Agent for Cyanide Copper Baths (R) 4- 84
Zinc Brighteners (R) 4- 88
Cyanide Copper Processes (R) 5-121
Grain Refiner for Cadmium (R) 5-124
Bright Copper Bath (P) 6- 82
Bright Brass Bath (P) 6- 85
Bright Nickel Plating Techniques (A) 6- 85
Copper Addition Agent (R) 6- 88
Bright Copper Plating Processes (R) 7- 84
Structure of Electroplated Tin Coatings (A) 8- 81
Bright Copper Process (R) 9- 83
Bright Copper Bath (P) 10- 79
Electrodeposition of Bright Zinc, Copper, or Nickel (P) 11- 79
Effects of Impurities in a Bright Nickel Bath on the Covering Power of a Chromium Bath 12- 46
Brighteners for Copper, Zinc and Nickel (P) 12- 72

BRUSH PLATING

Brush Plating Solutions (R) 2- 88
Brush Plater (M) 12- 91

BUFFING—See Polishing

BURNISHING—See Tumbling

CADMIUM PLATING

Stained Cadmium Plate (S) 1- 66
Bright Cadmium Bath (P) 3- 79
Cadmium and Zinc Plating (S) 4- 76
Protective Bright Dip for Cadmium (R) 4- 85
Cadmium vs. Zinc (S) 5-101
Modern Cadmium Plating Practice (A) 5-111
Grain Refiner for Cadmium (R) 5-124
Cleaning and Plating Steel Assemblies 6- 65
Stained Cadmium Plate (S) 6- 78
Fingerprints on Cadmium (S) 6- 78
Zinc and Cadmium for Corrosion Protection (A) 7- 80
Cadmium Bright Dip (R) 7- 83
Corrosion Behaviour of Cadmium and Nickel Coatings under Tropical Conditions (A) 10- 81
Cadmium Plating (S) 12- 70

CERAMIC COATINGS

Vitreous Enameling (P) 4- 79
Process for Enameling Steel (P) 7- 76
Porcelain Enameling (M) 9-118
Porcelain Repair (P) 10- 79
Porcelain Enameling (P) 11- 78

CHEMICALS AND PIGMENTS

Maintaining Chromic Anodizing Bath (S) 1- 65
Detergents (M) 1- 98
Silicones (M) 1-115
Sodium Copper Cyanide (R) 2- 86
Diglycol Laurate (M) 2-121
Plastics (M) 2-121
Chemicals (M) 3-123
Science for the Coatings Technologist 4- 52
Polyethylene Glycols (M) 4-131
Science for the Coatings Technologist 5- 89
Science for the Coatings Technologist 6- 53
Silicone Products (M) 6-131
Science for the Coatings Technologist 7- 56
Science for Electroplaters 7- 70
Neutral Trichlorethylene (R) 7- 85
Synthetic Detergents and Emulsifiers (B) 7-102
Organic Chlorine Compounds (M) 7-109
Science for the Coatings Technologist 9- 64
Science for Electroplaters 9- 67
Neutralizer Compound (R) 9- 88
Silicone Antifoams (R) 9- 96
Organic Specialties (M) 9-119
Science for the Coatings Technologist 10- 56
Science for Electroplaters 10- 74
Dry Salt Substitute for Acids (R) 10- 84
Rhodium Concentrate (R) 10- 88
Aluminum Paste (R) 10- 91
Degreasing Solvent (R) 10- 93
Metal Degreasing (M) 10-114
Acid Cleaner for Metals (R) 11- 82
Rinse Additive (R) 11- 86
Non-Foaming Spray Wash Cleaners (R) 12- 81

CHROMIUM PLATING

Plating on Beryllium (S) 1- 65
Plastics for Chromium Solution (S) 1- 67
Method of Chromium Plating (P) 1- 73
Mechanism of Chromium Plating (A) 1- 74
New Japanese Hard Chromium Plant 2- 55
Barrel Chromium Plating Continuous Bulk Processing 2- 58
Hard Chromium (S) 2- 75
Chromium Coatings on Die Cast Tin Alloys (A) 2- 77
Determination of Porosity of Chromium Plated Coatings (A) 2- 78
Nitrided Gun Barrel with Chromium Deposit (P) 2- 80
Chromium Plating (P) 2- 80
Chromium Plating Bath (P) 2- 81
Method of Chromium Plating (P) 2- 83
Coating Build-up on Gauges (S) 3- 77
Reactions Occurring During Electrolytic Reduction of Chromic Acid Containing Sulfuric Acid (A) 3- 83
Hard Chromium Service (M) 3-121
Cold Chromium Plating in Russia 4- 56
Chromium Plating Thickness 4- 58
Stripping Chromium (S) 4- 75
Etching for Hard Chromium (S) 4- 75
Chromic Acid Stains (S) 4- 76
Repair of Worn Motor Parts with Chromium (A) 4- 80
Test Kits for Chromium Plating Additive (R) 4- 82
Chromium Plating (P) 5-106
Chromium Plating Piston Rings of Magnesium-Containing Cast Iron (A) 5-111
Hard Chromium Plating of Cutting Tools (A) 6- 85
Chromium Plating with Multiple Coatings (A) 6- 86
Lacquering Over Chromium Plate (S) 7- 74
Black Chromium (S) 7- 75
Influence of Electroplating and of Hard Chromium Plating on the Fatigue Resistance of XC 48 Steel (A) 7- 81
The Technique of Non-Destructive Metallographic Examination; Application to Hard Chrome Plating (A) 7- 81
Some Notions of the Influence of Hard Chromium Plating on the Fatigue Limit of Engineering Parts (A) 7- 81
Influence of the Impurities of Bright Nickel Plating Baths on the Throwing Power of Chromium Plating Baths (A) 7- 81
Finishing Gun Barrels (S) 8- 76
Concentration Changes in Electrode Films in Chromium Baths and the Mechanism of Deposition (A) 8- 80
Study of the Functioning of Chromium Plating Baths by Radioactivity; Study of the Porosity of Deposits by the Aid of Radioactive Tracers; Estimation of Trivalent Chromium (A) 8- 80
Possibilities of Improvement of Cathodic Efficiency and Covering Power in Chromium Plating Baths (A) 8- 81
Stress Relief (S) 9- 75
Mechanism of the Electrodeposition of Chromium (A) 9- 78
Phenomena Occurring During Electrolytic Reduction of Aqueous Sulfate-Containing Chromic Acid Solutions (A) 9- 79
Cold Chromium Plating of Dies with a Large Surface Area (A) 9- 79
Chromium Plating Anode (R) 9- 94
Plating on Tin (S) 10- 77
Wear Resistance of Hard Chromium Plated Drop-Forge Dies (A) 10- 81
Electroless Chromium Plating (P) 11- 79
Hard Chromium Plating of Machine Parts (A) 11- 80
Chromium Plating Process (R) 11- 94
Effects of Impurities in a Bright Nickel Bath on the Covering Power of a Chromium Bath 12- 46
Iron Analysis in Chromium Solutions 12- 64
Chromium Plating Unit (R) 12- 76

CLEANING

Fused Bath Cleaning (P) 1- 73
Electrolytic Cleaning (A) 1- 74
Ultrasonics in Metal Cleaning Processes (A) 1- 75

Metal Cleaning with Alkaline Cleaners (A) 1- 76
Zinc and Aluminum Cleaners (R) 1- 83
Portable Ultrasonic Cleaning Unit (R) 1- 85
Ultrasonic Cleaning (M) 1-116
Soak Cleaner (M) 1-116
Test Run of a Supersonic Cleaning and Degreasing Plant (A) 2- 77
Fused Bath Cleaning (P) 2- 81
Cleaning Table (P) 2- 83
Ultrasonic Cleaner (R) 2- 86
Spray Mask Washer (R) 2- 90
Cleaning Machine (R) 2- 94
Phosphating Cleaner (R) 2- 94
Metal Cleaning Bibliographical Abstract (B) 2- 96
Cleaning with Silicates (M) 2- 123
Spray Cleaning, Pickling and Phosphating 3- 48
Strike Cleaning 3- 69
Electrocleaning of Vanadium (P) 3- 79
Ultrasonic Metal Cleaning Practice (A) 3- 81
Surface Cleaning Treatments for Steels for Subsequent Painting (A) 3- 81
Ultrasonic Cleaner (R) 3- 88
Buffing Compound Remover (R) 3- 93
Ultrasonic Cleaners (M) 3-120
Steam Cleaner (M) 3-122
Large Scale Ultrasonic Cleaner (R) 4- 94
Emulsion Cleaner (M) 4-131
Finishing Systems (M) 4-132
Alkaline Cleaner & Deruster (R) 5-126
Ultrasonic Cleaner (R) 5-128
Ultrasonic Cleaners (R) 5-129
Cleaning and Plating Steel Assemblies 6- 65
Washer and Degreaser (P) 6- 80
Fused Bath Cleaning (P) 6- 80
Ultrasonic Cleaning System (P) 6- 82
Metal Cleaning Apparatus (P) 6- 82
Vertical Conveyor Type Parts Washing Machine (R) 6- 94
Emulsion Cleaner (R) 6- 95
Automatic Mask Washer (R) 6-105
Tack Rags (M) 6-131
Spray Cleaners (M) 6-132
Centrifugal Machinery (M) 6-132
Paint Roller Cleaner (P) 7- 76
Reverse Current Cleaner (R) 7- 82
Aluminum Cleaner (R) 7- 87
Alkaline Deruster (R) 7- 91
Synthetic Detergents and Emulsifiers (B) 7-102
Ultrasonic Cleaners (M) 7-108
Alkaline Deruster (M) 7-108
Ultrasonic Cleaning (M) 7-109
Buffing Compound Remover (R) 8- 83
Cleaner Test Kit (R) 8- 83
Alkaline Cleaner (R) 8- 87
Cleaning-Phosphating Material (R) 8- 88
Parts Washer (P) 9- 76
Strip Cleaning and Processing Machine (P) 9- 77
Ultrasonic Cleaner (R) 9- 87
Air Powered Part Cleaner (R) 9- 89
Parts Washer for Small Batches (R) 9- 92
Cleaning for Welding (R) 9- 94
Applications for Alkaline Descaling Cleaners 10- 46
Continuous Strip Cleaning (P) 10- 80
Mask Washing Machine (R) 10- 84
500-Watt Ultrasonic Cleaner (R) 10- 91
5-Gallon Ultrasonic Cleaner (R) 10- 95
Metal Degreasing (M) 10-114
Paint Brush Cleaner (P) 11- 78
Paint Remover and Brush Flattener (P) 11- 78
Ultrasonic Cleaning (P) 11- 78
Cleaning Costs (M) 11-113
Electrocleaner for Brass (P) 12- 72
Apparatus for Cleaning Paint Rollers (P) 12- 73
Paint Brush Cleaning (P) 12- 73
Cleaning-Phosphating Composition (P) 12- 73
Non-Foaming Spray Wash Cleaners (R) 12- 81
Ultrasonic Cleaner (R) 12- 82
Electrocleaner for Zinc Die Castings (M) 12- 92

COLOR AND LIGHTING

Paint Toning (P) 7- 76

COLOR BUFFING—See Polishing

COLORED SURFACE TREATMENTS

Patina Coatings on Copper and Copper Alloys (A) 1- 76
"Oxidized" Silver (S) 2- 76
Anodic Oxidation of Copper and Its Alloys—Black Coloration (A) 3- 83
Coloring Anodized Aluminum (P) 5-106
Black Finish on Steel (S) 6- 78
Black Anodizing Aluminum (S) 6- 79
Caustic Black for Steel (P) 7- 76
Coloring Stainless Steels (A) 7- 79
Black Finish for Steel (M) 7-109
Coloring Gun Barrels (S) 9- 74
Color Anodizing (M) 9-117
Light-Fastness of Organic Dyes on Anodized Aluminum 11- 48
Multiple Finishes (S) 11- 75
Coloring Bronze Plaques (S) 12- 70

COMPOSITIONS, BUFFING AND POLISHING

Buffing Compound Remover (R) 3- 93
Spray Gun Mover for Liquid Buffing Compound (R) 5-112
Liquid Tripoli Buffing Composition (R) 5-114
Correct Formulation of Buffing and Polishing Compositions (A) 10- 82
Polishing Wheel Lubricant (R) 10- 84
Liquid Buffing Composition (P) 11- 79
Steel Buffing Composition (R) 11- 82

CONVERSION SURFACE TREATMENTS

Conversion Coating (P) 1- 68
Conversion Coating for Aluminum (P) 1- 72
Conversion Coating for Zinc (P) 1- 72
Conversion Coating (P) 1- 73
Progress in Surface Treatment of Magnesium Alloys (A) 1- 76
Conversion Coating for Zinc (R) 1- 78
Conversion Coating (P) 2- 80
Phosphating Cleaner (R) 2- 94
Spray Cleaning, Pickling and Phosphating 3- 48
How Grit Blasting Improves Phosphate Coatings 3- 57
Preventing "White Rust" on Zinc (S) 3- 77
Solution Surface Blanket (R) 3- 96
Phosphating Compounds (M) 3-130
Phosphating Treatments 4- 71
Oxalate Coating (P) 4- 79
Phosphating Compositions (P) 4- 79
Chemical Treatments of Metals (M) 4-131
Phosphating Treatments 5- 97
Sealing Tin Plate (S) 5-101
Protective Film for Ferrous Metals (P) 5-102
Conversion Coating (P) 5-106
Conversion Coating (P) 5-108
Conversion Coating (P) 5-109
Improvement of Corrosion Resistance of Metals by Chemical Treatments (A) 5-110
Conversion Coatings for Aluminum (M) 5-161
Corrosion of Zinc Plated Steel 6- 46
Phosphating Treatments 6- 72
Fingerprints on Cadmium (S) 6- 78
Oxide Coating on Aluminum (P) 6- 80
Conversion Coating (P) 6- 80
Variations of the Density of Phosphate Coatings on Steel (A) 6- 86
Accelerated Corrosion Tests of Passivated Zinc Coatings (A) 6- 87
Cold Phosphating (R) 6- 96
Phosphate Coating for Steel (M) 6-132
Phosphating Treatments 7- 66
Protecting Phosphated Surfaces (P) 7- 77
Phosphate Conversion Coating (P) 7- 77
Chemical Oxidation Processes for Aluminum (A) 7- 79
Chromate Conversion Coatings (R) 7- 83
Phosphating Treatments 8- 70
Chromate Finish for Zinc (R) 8- 88
Cleaning-Phosphating Material (R) 8- 88
Phosphating Treatments 9- 71
Flow Coated Paint Film (S) 9- 75
Conversion Coating (P) 9- 77
Phosphating Process (R) 9- 97
Phosphating Analysis (M) 9-118
Phosphating Treatments 10- 72
Aluminum Conversion Coating (P) 10- 79
Conversion Coating (P) 10- 80
Conversion Coating Machine (R) 10- 86
Olive Drab Conversion Coating (R) 10- 89
Conversion Coatings (M) 10-114
Chromate Coatings (M) 10-114
Phosphating Process (M) 10-115
Protective Oxide on Iron (P) 11- 77
Sulfide Conversion Coating (P) 11- 79
Stainless Steel Conversion Coating (R) 11- 86
Full Automatic Conversion Coating Machine (M) 11-113
Phosphating Compound (M) 11-113
Conversion Coating (P) 12- 73
Cleaning — Phosphating Composition (P) 12- 73
Treating Stainless Steel (P) 12- 73
Passivation of Zinc Coatings in Chromate Solutions (A) 12- 74
Phosphate Coating for Steel and Iron (R) 12- 78
Anti-Friction Phosphate Coating (R) 12- 83

COPPER PLATING

Acid Copper Electroforming (S) 1- 66
Acid Copper Plating Process (R) 1- 84
Influence of Periodic Current Reverse with Copper Plating from Sulfate Baths (A) 2- 77
Internal Stresses in Electroplated Copper (A) 2- 78
Addition Agent for Acid Copper Bath (P) 2- 80
Copper Backed Mirrors (P) 2- 84
Acid Copper Addition Agent (R) 2- 86
Bright Copper Plating (P) 3- 89
Copper Anodes (M) 3-129
Chlorides in Copper Solutions (S) 4- 75
Copper Anode (P) 4- 79
Addition Agent for Cyanide Copper Baths (R) 4- 84
Cyanide Copper Processes (R) 5-121
Bright Copper Bath (P) 6- 82
Copper Addition Agent (R) 6- 88
Copper Plating from Pyrophosphate Baths (A) 7- 79
Bright Copper Plating Processes (R) 7- 84
Immersion Copper on Brass (S) 8- 76
Modern Cyanide Copper Baths (A) 8- 80
Iron in Acid Copper Solution (S) 9- 74
Bright Copper Process (R) 9- 83
Bright Copper Bath (P) 10- 79
Electrodeposition of Bright Zinc, Copper, or Nickel (P) 11- 79
Brighteners for Copper, Zinc and Nickel (P) 12- 72

COSTS AND GENERAL

Technical Developments of 1957 ..... 1- 40
Organic Finishing Developments of 1957 ..... 1- 50
Transactions Institute Metal Finishing (B) 1- 88
Chemical Engineering Catalog (B) 1- 88
Product Finishing Guide (M) 1-116
Mechanical Springs — Materials, Finishes and Embrittlement 2- 66
Surface Protection Treatments for Special Metals to Prevent High Temperature Oxidation (A) 2- 77
Electroplating Course (M) 2-131
Finishing Equipment (M) 2-131
Measuring Loads of Solid Flat Steel Parts 3- 70
Coating Build-up on Gauges (S) 3- 77
Planned Layouts for Modern Plating Plants (A) 3- 81
Science for Electroplaters 4- 68
Chromic Acid Stains (S) 4- 76
Science for Electroplaters 5- 93
Institute of Metal Finishing Holds 1958 Conference 6- 66
Science for Electroplaters 6- 76
Plant Design and Economies for Chemical Engineers (B) 6-119
Metal Industry Handbook & Directory (B) 6-119
Engineering Formulas and Tables (B) 6-120
A.E.S. Meets in Cincinnati 7- 60
Design of a Plating Line 7- 65
Science for Electroplaters 7- 70
Energy Relationships in Plating and Metal Finishing Baths (A) 7- 81
Metals Engineering — Processes (B) 7-102
Coatings and Processes (M) 7-108
Western Electric's Modern Metal Finishing Plant 8- 48
Science for Electroplaters 8- 73
Plating Room Layout 9- 52
Reducing Spray Painting Costs 9- 58
Science for Electroplaters 9- 67
Electrochemical Society Meets in Ottawa 10- 68
Science for Electroplaters 10- 74
Protective Packaging Film for Metal Products (R) 10- 91
Science for Electroplaters 11- 73
Cleaning Costs (M) 11-113
Directory of New England Manufacturers (B) 11-116
Science for Electroplaters 12- 66
Transactions Institute Metal Finishing (B) 12-101

DEGREASING

Emulsion Degreasing (A) 1- 74
Metal Cleaning with Acid Media (A) 1- 75
Test Run of a Supersonic Cleaning and Degreasing Plant (A) 2- 77
Ultrasonic Degreaser (P) 2- 85
Ultrasonic Cleaner (R) 2- 86
Cold Solvent (R) 3- 92
Degreasing Machine (P) 4- 78
Vapor Degreasing (M) 4-131
Vapor Degreaser (P) 6- 83
Emulsifiable Solvent Cleaner (R) 6- 88
Neutral Trichlorethylene (R) 7- 85
Ultrasonic Degreaser (R) 8- 86
Solvent-Vapor Degreaser (P) 9- 76
Degreasing Solvent (R) 10- 93
Metal Degreasing (M) 10-114
Cold Cleaning Solvents (M) 12- 92

DEIONIZATION—See Water

DESCALING—See Pickling

DIE CASTINGS

Troubles Caused by Too Severe Specifications for Plated Zinc Die Castings for Autos and Their Avoidance (A) 6- 86
Plating Die Castings (S) 8- 76
Finishing Zinc Base Die Castings 11- 58
Finishing Zinc Base Die Castings 12- 56
Electrocleaner for Zinc Die Castings (M) 12- 92

ELECTROCLEANING—See Cleaning

ELECTROFORMING

Acid Copper Electroforming (S) 1- 66
Electroforming (P) 5-105
Electroformed Wave Guides (P) 10- 80
Electroforming with Plating Cells 12- 62

ELECTROPOLISHING

Regeneration of Electrolytes Used for Electropolishing Steel — Removal of Iron (A) 1- 77
Mechanism of Electropolishing Nickel (A) 2- 79
Electrodeposition of Nickel and Nickel Alloys (P) 2- 85
Electropolishing Magnetic Articles (P) 2-110
Electropolishing Copper, Brass and Aluminum 2- 64
Electropolishing — What, How and Why 8- 44
Electropolishing Gold (S) 8- 76
The Surface Characteristics of Steels After Electropolishing (A) 8- 81
Electropolishing — What, How and Why 9- 60
Electropolishing 10- 67
Electropolishing Tungsten (S) 10- 78

ETCHING—See Pickling

FILTERS AND PUMPS

Metering Pump (R) 1- 86
Filtration Equipment (M) 1- 98

Filter Aid (M) 1-115
Filter-Separator (M) 1-116
Suction Pump (R) 2- 93
Controlled Volume Pumps (M) 2-121
Self-Priming Filter Pumps (R) 3- 89
Dual Manifold Vacuum Filter (R) 3- 91
Glass-Lined Pumps (M) 3-121
Pumping Metal Etch Solutions (M) 3-123
Compressed Air Filter (R) 4- 91
Filtration Tanks (R) 4- 92
Rubber Lined Filter Pumps (R) 5-114
Rotary Air and Vacuum Pump (R) 5-120
Plastic Pump (R) 5-125
Stainless Steel Filter (R) 5-133
Centrifugal Pumps (R) 6- 94
Hard Rubber Gear Pump (R) 6- 96
Nickel-Teflon Pumps (R) 6-100
Continuous Self-Cleaning Filter (R) 6-106
High Capacity Filter (R) 6-106
Canned Motor Pumps (M) 7-108
Portable Solution Filter (R) 8- 84
Chemical Pump (R) 8- 89
Cylinder Disk Filter (R) 8- 90
Paint Circulating Pumps (R) 9- 93
Air Filter & Water Separator (R) 9- 93
"Canned" Filter Pump (R) 10- 84
Rotary Vacuum Pumps (R) 10- 90
Stainless Steel Pumps (R) 10- 99
Graphite Pumps (R) 10- 99
Filters (M) 10-115
Paint Supply Pump (R) 11- 85
In-The-Tank Filter (R) 11- 93
Pumps and Their Uses in Spray Painting 12- 54
High Vacuum Diffusion Pump (R) 12- 83
Carbon and Graphite for Chemical Applications (M) 12- 92

FIRST AID — See Safety Procedures & Equipment

GAS PLATING

Improvement of Wear Resistance of Cold Stamping Dies by Chromizing (A) 2- 79
Gas Plating (P) 3- 79
Process of Chromizing (P) 5-104
Gas Plating (P) 5-105
Gas Plating (P) 6- 80
Gas Plating (P) 6- 81
Gas Plating (P) 6- 84
Influence of Diffused Chromium Coatings on Oxidation Resistance of Steels and Alloys of Nickel and Cobalt (A) 6- 85
Gas Plating (P) 6- 85
Gas Plating (P) 7- 78
Chromizing Process (P) 10- 79
Gas Plating (P) 12- 74

GENERATORS—See Power Supplies

GRINDING—See Polishing

HANDLING EQUIPMENT

Wire Baskets (M) 2-123
Flexibility and Labor Reduction Feature New Plating Department 3- 65
Paint Mixing Apparatus (P) 3- 78
Barrel and Box Grab (R) 3- 84
Dispenser Carton for Brighteners (R) 3- 84
Loading Arm (R) 3- 88
Dimensional Separator (R) 3- 98
Drum Handler (R) 3- 99
Conveyor Chain (M) 3-130
Conveyor Carriers (R) 5-119
Hand Trucks (R) 5-128
Washer and Degreaser (P) 6- 80
Metal Cleaning Apparatus (P) 6- 82
Air Operated Rinse Hoppers (R) 6- 90
Automatic Rack Turnaround (R) 6- 97
Electric Lift Truck (R) 6-106
Belt Conveying Systems (M) 6-132
Pouring Lip for Paint Cans (P) 7- 76
Dipping Baskets That Nest (R) 7- 83
Conveyors (M) 7-109
Belt Conveyor Systems (M) 7-109
Parts Recovery Scoop (R) 8- 85
Conveyor Drive (R) 9- 86
Drum Carrier (R) 9- 96
Gravity Conveyor (M) 9-118
Roller Conveyors (M) 9-118
Ball Bearing Trolleys (M) 9-119
Portable Dumping Lifter (R) 10-100
Dipping Basket (R) 11- 84
Drum Cradles and Racks (R) 11- 92
Electroplating Apparatus (P) 12- 72
Automatic Plating Machine (R) 12- 81
Multi-Process Automation (R) 12- 83

HEATING AND COOLING

Float-Thermostatic Steam Trap (R) 1- 80
Thermostat (R) 1- 84
Graphite Heat Exchangers (M) 1- 98
Explosion-Proof Remote Temperature Control (R) 2- 89
Graphite Heat Exchanger (R) 2- 92
Infra-Red Radiant Heating Units (R) 2- 92
Heating Elements (M) 2-121
Temperature Controls (M) 2-123
Graphite Heat Transfer Equipment (M) 2-131
Paint Preheaters (P) 3- 78
Graphite Plate Heater (R) 3- 84
Temperature Control (R) 3- 92
Industrial Heaters (M) 3-123
Plate Coils (M) 3-129
Heat Exchange Coils (R) 4- 94
Heat Transfer Units (M) 4-131
Temperature Controller (R) 5-127
Graphite Heat Exchanger Tube (R) 5-132
Heating, Ventilating (M) 5-161
Corrosion-Resistant Thermostats (R) 6-106
Ovens, Dryers, and Heaters (M) 7-107
Temperature Chart (M) 7-108
Submerged Combustion System (M) 8- 93
Temperature Controls (M) 8- 93
Heat Exchangers (M) 9-118
Heaters and Devices (M) 10-115
Solution Cooler (R) 11- 85
Recording Temperature Controller (R) 11- 87
Immersion Electric Heaters (M) 11-114
Carbon and Graphite for Chemical Applications (M) 12- 92

HOT DIP COATINGS

Hot-Galvanizing (P) 1- 68
Coating Steel Strip (P) 1- 68
Hot Dip Aluminum (P) 2- 83
Comparison Between Hot-Dip Zinc and Zinc Plating (A) 3- 82
Hot Dip Coating Wire (P) 4- 78
Prevention of "Tear" Formation with Hot Dip Tin Coatings (A) 4- 81
Hot Galvanizing (P) 5-108
Hot Dipping Aluminum (P) 7- 76
Hot Dipping (P) 8- 80
Hot Dipping (P) 9- 76
Hot Dipping (P) 9- 77
Greville Process of Hot Dip Tinning (A) 10- 82
Galvanizing Flux (P) 11- 79
Hot Metallic Coating (M) 11-112
Coating Aluminum (P) 12- 74

HYDROGEN EMBRITTLEMENT

Mechanical Springs — Materials, Finishes and Embrittlement 2- 66
Influence of Pickling Additions on Embrittlement (A) 3- 81
Hydrogen Embrittlement of Carbon Steels During Pickling and Metal Plating (A) 6- 85

IMMERSION PLATING

Copper Backed Mirrors (P) 2- 84
Immersion Lead Bath (P) 5-108
Electrical Conductivity of Electroless Nickel Coatings (A) 5-110
Electroless Nickel (P) 6- 80
Electroless Nickel Plating (P) 6- 84
Electroless Nickel (P) 7- 76
Electroless Process for Nickel Plating Magnesium (R) 7- 82
Immersion Copper on Brass (S) 8- 76
Electroless Nickel (P) 8- 78
Immersion Tin (P) 8- 78
Electroless Iron Deposition (P) 11- 77
Electroless Deposition of Iron Alloys (P) 11- 77
Electroless Deposition of Vanadium Alloys (P) 11- 77
Electroless Depcsition of Vanadium Alloys (P) 11- 78
Electroless Chromium Plating (P) 11- 79
Electroless Nickel (M) 12- 91

INHIBITORS

Acid Pickling Inhibitor (P) 2- 84
Influence of Pickling Additions on Embrittlement (A) 3- 81
Acid Inhibitor (P) 4- 77
Acid Inhibitor (P) 4- 78
Acid Inhibitor (M) 4-132
Acid Inhibitor (R) 5-127
Acid Pickling Inhibitor (R) 6-101
Acid Pickling Inhibitor (P) 9- 76
Protective Paper Wrapping (R) 9- 89
Acid Pickling Solution (P) 12- 73

INSTRUMENTS, INDUSTRIAL

Thermostat (R) 1- 84
Corrosion Proof Flowmeter (R) 1- 85
Thickness of Lead Deposits 2- 52
Explosion-Proof Remote Temperature Control (R) 2- 89
Humidity and Temperature Instruments (M) 2-122
Temperature Controls (M) 2-123
Temperature Control (R) 3- 92
Recording Thermometers (M) 3-121
Industrial pH Equipment (M) 3-122
Testing Instruments (M) 3-130
High Current Ammeter (R) 4- 84
Dry Film Thickness Gage (P) 5-109
Coating Thickness Tester (R) 5-126
Temperature Controller (R) 5-127
Abrasion Testing Instrument (R) 5-132
Wet Film Gauge (R) 6- 97
Current Density Indicator and Control (P) 7- 77
Tong Test Ammeters (R) 8- 88
Humidity Indicator (R) 8- 90
Temperature Controls (M) 8- 93
Instruments & Equipment (M) 8- 94
Temperature Indicating Controller (M) .. 8- 94
Magnetic Flow Meters (M) 10-114
Recording Temperature Controller (R) .. 11- 87
Flowmeter (M) 12- 90
Tong Test Ammeter (M) 12- 92

IRON PLATING

Wood in Iron Baths (S) 2- 76
Iron Bath (P) 4- 79
Electroless Iron Deposition (P) 11- 77
Electroless Deposition of Iron Alloys (P) 11- 77

LEAD PLATING

Thickness of Lead Deposits 2- 52
Immersion Lead Bath (P) 5-108

LEVELING

Mechanism of the Leveling Effect in Nickel Plating (A) 12- 75

MAGNESIUM

Progress in Surface Treatment of Magnesium Alloys (A) 1- 76
Chemical Brightening Magnesium (S) 5-102
Plating on Magnesium (P) 5-104
Electroless Process for Nickel Plating Magnesium (R) 7- 82

MASKS

Masking Aids (M) 1-115
Spray Mask Washer (R) 2- 90
Masking Tapes (M) 2-122
Automatic Mask Washer (R) 6-105
Mask Washing Machine (R) 10- 84
Flatback Paper Tapes (R) 10- 98
High Temperature Masking Tape (R) 11- 92

METALIZING

Printed Circuits (S) 1- 67
Metalising Plastics (S) 2- 75
Copper Backed Mirrors (P) 2- 84
Coppering of Plastics Prior to Plating (A) 3- 83
Copper Film Process (R) 3- 96
Metalizing (P) 7- 76
Silver Reduction Films (P) 7- 78
Metalized Plastics (M) 12- 92

NICKEL PLATING

Firm Adherent Plating for Aluminum 1- 53
Bright Nickel Bath (P) 2- 82
Bright Nickel Bath (P) 2- 83
Nickel Sulfamate Bath (S) 3- 77
Quality Requirements for Nickel Anodes (A) 3- 82
Choice of Nickel Plating Baths (A) 3- 82
Stripping Chromium (S) 4- 75
Laminated Nickel Deposits (S) 4- 75
Brass on Bright Nickel (S) 4- 75
Factors Affecting Residual Stress in Electrodeposited Metals 5- 82
Zinc Removal from Nickel Baths (S) 5-101
Ductile Barrel Nickel (S) 5-102
Electrical Conductivity of Electroless Nickel Coatings (A) 5-110
Brass on Bright Nickel (S) 6- 79
Electroless Nickel (P) 6- 80
Nickel Plating (P) 6- 81
Electroless Nickel Plating (P) 6- 84
Bright Nickel Plating Techniques (A) 6- 85
Nickel Plating Porous Metal (S) 7- 75
Electroless Nickel (P) 7- 76
Acceleration of Nickel Plating (A) 7- 80
Influence of the Impurities of Bright Nickel Plating Baths on the Throwing Power of Chromium Plating Baths (A) 7- 81
Electroless Process for Nickel Plating Magnesium (R) 7- 82
Electroless Nickel (P) 8- 78
Influence of Chloride Ions on Solubility of Nickel Anodes (A) 8- 80
Thermal Shock Resistant Nickel Plating on Copper 9- 49
Refinishing Dental Instruments (S) 9- 74
Plating Nickel Over Nickel (S) 9- 74
Darkening of Lacquered Brass (S) 9- 74
Anode Protection (R) 9- 99
Plating on Tin (S) 10- 77
Corrosion Behaviour of Cadmium and Nickel Coatings under Tropical Conditions (A) 10- 81
Nickel Stripper (R) 10- 90
Electrodeposition of Bright Zinc, Copper, or Nickel (P) 11- 79
Effects of Impurities in a Bright Nickel Bath on the Covering Power of a Chromium Bath 12- 46
Brighteners for Copper, Zinc and Nickel (P) 12- 72
Mechanism of the Leveling Effect in Nickel Plating (A) 12- 75
Low-Sludge Nickel Anode (R) 12- 82
Electroless Nickel (M) 12- 91

ORGANIC COATINGS

Paint Preheaters (P) 3- 78
Paint Mixing Apparatus (P) 3- 78
Paint Remover Composition (P) 3- 79
Surface Cleaning Treatments for Steel for Subsequent Painting (A) 3- 81

ORGANIC COATINGS

CLEAR

Brown Stains in Lacquer Coating (S) 4- 75

ORGANIC COATINGS

CORROSION RESISTANT

Corrosion-Inhibiting and Fingerprint-Removing Composition (P) 1- 68
Coating Composition (P) 1- 69
Coating Composition (P) 1- 70

Colorless Coating for Metal Surfaces (R) 1- 78
Rust Preventive (R) 1- 86
Corrosion Preventives (M) 1- 97
Severe-Duty Varnish (R) 2- 93
Catalytic Coatings (M) 2-121
Plastic Type Protective Coating (M) 2-123
Organic Finishes (R) 3- 90
Organic Finishes (R) 3- 90
Coatings and Linings (R) 3-100
Spray-Type Rust Preventive (M) 3-121
Resistant Coating (R) 4- 93
Rust Preventive Chart (M) 4-131
Organic Protective Coatings (M) 4-132
Organic Coatings (M) 4-132
Protective Coating (P) 5-103
Polytrifluorochloroethylene-Coated Aluminum (P) 5-104
Clear Protective Coating (R) 5-112
Baking Enamels (R) 5-116
Corrosion Resistant Coatings (R) 5-131
Corrosion Prevention (P) 6- 82
Rust Preventive Compositions (P) 6- 84
Rust Preventive (R) 6-102
Corrosion Preventive (P) 9- 77
Rust Preventive Coating (R) 9- 92
Corrosion Resistant Paint (R) 9- 97
Paint Color Chart (M) 9-119
Polytetrafluoroethylene Coating (P) 10- 79
Coating Composition (P) 10- 79
Corrosion Preventive (P) 10- 80
Protective Coating (R) 11- 89
Vapor Phase Corrosion Inhibitor (P) 12- 72

ORGANIC COATINGS
DECORATIVE AND SPECIAL

Heat Resistant Paint (R) 2- 91
Severe-Duty Varnish (R) 2- 93
Emulsion Coating Composition (P) 4- 77
Coating Composition (P) 4- 79
Dip Coating for Matching Purposes (S) 5-101
Organic Coating (P) 5-103
Thermosetting Acrylic Finish (R) 5-120
Paint Compositions (P) 6- 81
Baking Enamels (P) 6- 84
Baking Enamel (R) 6- 99
Wrinkle Finish (R) 6-104
Fusion Bond Finishes (M) 6-131
Plastic Coating (M) 6-131
Polyvinyl Plastisols (M) 7-108
Improving Paint Adhesion on Phenolic Surfaces 9- 57
Hammer Finish (P) 9- 76
Decorative One-Coat Organic Finish (R) 9- 87
Aluminum Paint (P) 10- 80
One-Coat Metal Primer-Finish (R) 10- 98
Pore Sealer (R) 10- 99
New Water Soluble Baking Paint Makes its Debut 11- 70
Organic Finishes (R) 11- 93
Textured Vinyl Finish (R) 12- 76

ORGANIC COATINGS
FLOCK

Automatic Coating Spray Unit for Flocking Machines (P) 5-104

ORGANIC COATINGS
HEAT RESISTANT

Heat-Resistant Finish Compositions and Vehicles Therefor (P) 3- 79

ORGANIC COATINGS
LACQUER

Bronzing Lacquer (P) 6- 81

ORGANIC COATINGS
METALLIC

Science for the Coatings Technologist 4- 52
Bronzing Lacquer (P) 6- 81
Metallic Baking Enamel (R) 6- 99
Aluminum Paste (R) 10- 91

ORGANIC COATINGS
MISCELLANEOUS

Government Specifications Catalog (M) 2-122
New Vinyl Paint Facilities at Poughkeepsie IBM 4- 59
Science for the Coatings Technologist 7- 56
Organic Finishing of Aluminum and its Alloys 8- 58
Science for the Coatings Technologist 9- 64
Science for the Coatings Technologist 10- 56
Organic Finishes (M) 10-114

ORGANIC COATINGS
ORGANIC COATING APPLICATION

Spraying Apparatus (P) 1- 69
Electrostatic Coating Method (P) 1- 70
Painting Device (P) 1- 70
Electrostatic Spraying (P) 1- 71
Shielded Roller Painting Device (P) 1- 71
Anti-Splash Shield for Paint Pans (P) 1- 71
Surface Marking Apparatus (P) 1- 71
Spraying Apparatus (P) 1- 71
Flocking Machine (R) 1- 82
Roller Coater (R) 1- 86
Spray Gun (R) 2- 89
Spray Guns and Booths (M) 2-121
Airless Spray Painting (M) 2-131
New Literature Release (M) 2-132
Interest Grows in Hot Spray Painting 3- 63
Paint Applying Device (P) 3- 78
Apparatus for Internally Spraying Pipes (P) 3- 78
Paint Can Attachment (P) 3- 78
Electrostatic Coating Device (P) 3- 78
Electrostatic Spraying (P) 3- 79
Paintbrush Holder and Scraper (P) 3- 79
Electrostatic Spray Painting Apparatus (P) 3- 80
External Mix Nozzle Spray Guns (R) 3- 89
Air Compressors (R) 3- 92
"Package" Electrostatic Spray Systems (R) 3- 96
Automatic Spray Gun (R) 3- 98
Air Compressors (M) 3-122
Paint Applicator (P) 4- 77
Paint Roller (P) 4- 77
Rotary Painting Brush (P) 4- 77
Guard Attachment for a Paint Applying Roller (P) 4- 78
Guide Attachment for Paint Brushes (P) 4- 78
Paint Brush Holders (P) 4- 78
Electrostatic Spraying (P) 4- 78
Paint Brush Holder (P) 4- 79
Electrostatic Coating (P) 4- 79
Spray Painting System (P) 4- 79
Airless Paint Spray Unit (R) 4- 85
Painting Machine (R) 4- 97
Portable Air Compressor (M) 4-131
Spray Painting Equipment (M) 4-132
Spray Painting Machines (P) 5-103
Hardening Organic Coatings (P) 5-103
Paint Roller and Mounting (P) 5-103
Preheating and Dipping Machine (P) 5-104
Electric Spray-Gun (P) 5-104
Spray Nozzle (P) 5-104
Paint Brush Wiper (P) 5-104
Dip Coating Machine (P) 5-104
Roller Coating Machine (P) 5-106
Apparatus for Coating Wire (P) 5-106
Paint Can Channel Cover and Brush Support (P) 5-106
Paint Roller (P) 5-108
Plastic Spraying Apparatus (P) 5-108
Spraying Apparatus (P) 5-109
Paint Can Attachment (P) 5-109
Pumping Unit for Airless Spraying (R) 5-121
Paint Spraying Process (R) 5-122
Portable Paint Pump (R) 5-123
Electrostatic Painting (M) 5-162
Installing Flow Coating Equipment (S) 6- 78
Paint Brush Holder (P) 6- 81
Paint Roller Shield (P) 6- 81
Paint Feeder and Guard (P) 6- 81
Paint Roller (P) 6- 82
Paint Roller (P) 6- 84
Moisture Extractor (R) 6- 96
Air Regulator (R) 6-101
Lacquering Over Chromium Plate (S) 7- 74
Annual Brush Element (P) 7- 77
Paint Brush Guard (P) 7- 77
Coating Removal Method (P) 7- 78
Paint Brush Guard (P) 7- 78
Automatic Spray Gun (R) 7- 83
Electrostatic Spray Systems (R) 7- 85
Portable Compressor (R) 7- 89
Spray Guns (M) 7-107
Automatic Spray Equipment (M) 7-108
Roller Coaters (M) 7-108
Spray Guns (M) 7-109
Extension Spray Guns (M) 7-109
Paint Brush (P) 8- 79
Organic Coating (P) 8- 79
Spray Booth Coating (R) 8- 87
Tack Rag (R) 8- 88
Reducing Spray Painting Costs 9- 58
Darkening of Lacquered Brass (S) 9- 74
Flow Coated Paint Film (S) 9- 75
Organic Coating (P) 9- 76
Paint Roller (P) 9- 76
Paint Roller (P) 9- 77
Vinyl Finish Applied in Dry Powder Form (R) 9- 80
Wood Grain Printer (R) 9- 84
Paint Circulating Pumps (R) 9- 93
Spray Gun Bracket (R) 9- 98
Maintenance Painting Units (M) 9-118
New Painting Facilities Effect Production Economics 10- 61
Paint Roller Scraper (P) 10- 79
Paint Brush Wiper (P) 10- 80
Electrostatic Coating (P) 10- 80
Spray Guns (P) 10- 80
Centrifugal Cleaning Apparatus for Paint Applicators (P) 10- 81
Spraying Hollow Articles (P) 10- 81
Air Compressors (R) 10- 87
Roller Coater (R) 10- 88
Portable Spray Unit (R) 10- 89
Spray Gun (R) 10- 92
Automatic Dipping Machine (R) 10- 98
Airless Spray (M) 10-115
Automatic Painting of Conduit Interiors 11- 63
Use of Automatic Machinery in the Spray Painting Field 11- 68
Exhausting Spray Booths (S) 11- 75
Wet-Wall Versus Dry-Wall Spray Booths (S) 11- 75
Electrostatic Coating Process (P) 11- 77
Paint Applicator (P) 11- 78
Spray Coating Means (P) 11- 78
Multi-Color Electrostatic Spray System (R) 11- 84
Paint Supply Pump (R) 11- 85
Airless Paint Spray System (R) 11- 87
Miniature Spray Gun (R) 11- 88
Automation Painting in Russian Machine Tool Manufacturing 12- 51
Pumps and Their Uses in Spray Painting 12- 54
Article Sprayer (P) 12- 73
Roller Coating Machine (P) 12- 73
Electrostatic Hand Spray Gun (R) 12- 76
Automatic Spray Gun (R) 12- 82
Automatic Spray Painting Machine (R) 12- 83
Paint Finishing in Industry (B) 12-101

ORGANIC COATINGS
SPECIAL PURPOSE

An Introduction to Wash Primers 1- 58
Coating Composition (P) 1- 68
Antifouling Paint (P) 1- 71
Interest Grows in Hot Spray Painting 3- 63
Silk Screening Resists (S) 3- 76
Coating Composition (P) 3- 78
Freeze Resistant Aqueous Polymer Containing Paint (P) 3- 79
Improving Insulation Properties of Varnish Coatings (S) 4- 76
Multi-Color Lacquer (R) 4- 82
Organic Coating for Vacuum Metalizing (R) 4- 95
Science for the Coatings Technologist 6- 53
Organic Coatings for Pest Control 6- 64
Epoxy Coating (P) 6- 83
Film Formation, Film Properties, and Film Deterioration (B) 7-102
"Profilm" Finish (S) 8- 76
Latex Paint (P) 8- 78
Epoxy Finishes (R) 8- 91
Phenolic Protective Coating (R) 9- 96
Vacuum Metalizing Coatings (M) 9-117
Organic Specialties (M) 9-119
Coating Interior of Aluminum Cans (S) 10- 77
Lacquering Steel Strip (P) 12- 74
Removable Plastic Coatings (R) 12- 82
Organic Coatings (M) 12- 91
Paint for Galvanized Surfaces (M) 12- 91
Paint Finishing in Industry (B) 12-101

ORGANIC COATINGS
STRIPPABLE

Strip Coating (R) 1- 86
Strippable Protective Coating (R) 7- 83
Peelable Plastic Coating (R) 7- 84

OXIDIZING—See Colored Surface Treatments

pH

Industrial pH Equipment (M) 3-122
The Industrial pH Handbook (B) 5-153

PHOSPHATE COATINGS—See Conversion Surface Treatments

PICKLING AND DESCALING

Rust and Scale Removal (S) 1- 66
Pickling Waste Treatment (P) 1- 71
Fused Bath Cleaning (P) 1- 73
Metal Cleaning with Acid Media (A) 1- 75
Fused Bath Cleaning (P) 2- 81
Acid Pickling Inhibitor (P) 2- 84
Etching Printed Circuits (M) 2-121
Spray Cleaning, Pickling and Phosphating 3- 48
Influence of Pickling Additions on Embrittlement (A) 3- 81
Aluminum Etchant (R) 3- 88
Acid Inhibitor (P) 4- 77
Pickling Stainless Steel (P) 4- 77
Acid Inhibitor (P) 4- 78
Acid Inhibitor (M) 4-132
Pickling Waste Treatment (P) 5-103
Matting Aluminum (P) 5-104
Alkaline Cleaner & Reruster (R) 5-126
Acid Fume Depressant (R) 5-126
Acid Inhibitor (R) 5-127
Fused Bath Cleaning (P) 6- 80
Acid Pickling Inhibitor (R) 6-101
Pickling Waste Recovery (S) 7- 74
"Walrine" and "Removing the Green" (S) 7- 74
Scale Removal (P) 7- 77
Energy Relationships in Sulfuric Acid Pickling Baths (A) 7- 78
Alkaline Derustor (R) 7- 91
Alkaline Rerustor (M) 7-108
Rust and Tarnish Remover (R) 8- 84
Fused Bath Descaling (P) 9- 76
Acid Pickling Inhibitor (P) 9- 76
De-Smutter for Aluminum (R) 9- 80
Flux Remover and Pickle (R) 9- 80
Stainless Steel Welding Stain Remover (R) 9- 82
Applications for Alkaline Descaling Cleaners 10- 46
Electrolytic Pickling of Stainless Steels (A) 10- 81
Dry Salt Substitute for Acids (R) 10- 84
Pickling 10K Gold (S) 11- 75
Method of Pickling Titanium and Titanium Alloys (P) 11- 77
Rejuvenating Aluminum Pickles (P) 11- 78
Pickling Brass Strip in Dilute Sulfuric Acid (A) 11- 80
Etching of Stainless Steels (A) 11- 80
Brass Pickling Baths (A) 11- 81
Acid Cleaner for Metals (R) 11- 82
Oxide and Tarnish Remover (M) 11-114
Plating on Beryllium-Copper (S) 12- 71
Acid Pickling Solution (P) 12- 73
Dialysis System for Acid Separation (R) 12- 80

PIPINGS AND FITTINGS, NOZZLES, VALVES

Plastics for Chromium Solution (S) 1- 67
Float-Thermostatic Steam Trap (R) 1- 80
Pressure Regulator (R) 1- 87
Stainless Dispensing Faucet (R) 1- 88
Plastic Gate Valve (M) 1- 97
Whirl Nozzles (R) 2- 95
Regulator Valve Sizing (M) 3-132
Spray and Blow Gun (P) 4- 80
High Vacuum Poppet Valves (R) 4- 86
Industrial Hose (M) 4-122
Wall-Mounting Nozzles (R) 4- 37
Spray Nozzle (P) 5-104
Monitoring System for Automatic Demineralizers (R) 5-114
Reagent Dispenser (R) 5-116
Spray Nozzles (R) 5-117
Solenoid Valves (R) 5-130
Insertable Union Check Valve (R) 5-132
Self-Closing Drum Faucet (R) 5-133
Hose Catalogs (M) 5-161
Three Way Valve (R) 6-100
Cleaning Guns (R) 6-100
Air Regulator (R) 6-101
High Vacuum Valves (M) 6-131
Air and Fluid Hose (M) 6-131
Pneumatic Atomizing Nozzle (R) 7- 90
High Vacuum Valves (M) 7-109
Self-Cleaning Pipeline Strainer (R) 9- 86
Acid Hose (R) 9- 14
Solenoid Valves (R) 9- 95
Polyethylene Syphon (R) 9- 96
Spray Orifice Tips (R) 10- 91
Fabricated PVC Pipe Fittings (R) 11- 94

PITTING

Pores and Pitting of Plated Deposits 10- 64

PLANT PRODUCTION METHODS

Plating Powder Metal Parts (S) 1- 65
Plating on Beryllium (S) 1- 65
Plating on Beryllium (P) 1- 71
Silver Plating Titanium (P) 1- 72
Aluminum Name Plates (S) 2- 75
Plating on Titanium (P) 2- 81
Brush Plating Solutions (R) 2- 88
Plated Refractory Metals (P) 3- 80
Cold Chromium Plating in Russia 4- 56
New Vinyl Paint Facilities at Poughkeepsie IBM 4- 59
Lead-Indium Bearings (S) 5-101
Plating Equipment (P) 5-103
Plating on Magnesium (P) 5-104
Cleaning and Plating Steel Assemblies 6- 65
Plating on Molybdenum (S) 6- 78
Plating on Molybdenum (S) 6- 79
Method of Plating Silicon (P) 6- 82
Bright Nickel Plating Techniques (A) 6- 85
Preparation of Iron-Chromium-Vanadium Alloy Steels for Plating (A) 6- 86
Corrosion Protection by Bright Plated Coatings (A) 6- 87
Plant Engineering Practice (A) 6-120
Method of Plating (P) 7- 77
Energy Relationships in Plating and Metal Finishing Baths (A) 7- 81
Turning Heads for Easier Selective Plating (R) 7- 88
Finishing Gun Barrels (S) 8- 76
Rusting of Replated Steel (S) 8- 77
Plating Soft-Soldered Parts (S) 8- 77
Plating Room Layout 9- 52
Plating Nickel Over Nickel (S) 9- 74
Superimposing A.C. on D.C. (P) 9- 77
Plating on Titanium (P) 9- 77
Printed Circuits Plating (M) 9-117
New Painting Facilities Effect Production Economies 10- 61
Plating on Tin (S) 10- 77
Silver Plating Bearings (S) 10- 78
Finishing Zinc Base Die Castings 11- 58
Automatic Painting of Conduit Interiors 11- 63
Use of Automatic Machinery in the Spray Painting Field 11- 68
Multiple Finishes (S) 11- 75
Blistering Around Fine Threaded Holes (S) 11- 76
Plating on Titanium (P) 11- 79
Metal Spraying (M) 11-115
Gold Finishing Lead Alloy (S) 12- 70
Plating on Beryllium-Copper (S) 12- 71
Plating on Aluminum (S) 12- 71
Electroplating Apparatus (P) 12- 72
Lacquering Steel Strip (P) 13- 74

PLASTICS—See Organic Coatings and Metallizing

PLATING MISCELLANEOUS METALS

Anti-Tarnish Coating on Silver (S) 1- 65
Zirconium Bath (P) 1- 68
Plating on Beryllium (P) 1- 71
Tungsten Plating (S) 2- 76
Action of Ultrasonic Vibrations on Metal Plating Processes (A) 2- 78
Antimony Bath (P) 2- 84
Silver Tarnish Removal (P) 2- 84
Electroplating and Corrosion (M) 2-131
Factors Affecting Residual Stress in Electrodeposited Metals 4- 46
Protective Coating (P) 5-106
Antimony Plating Bath (P) 6- 82
Bismuth Plating (P) 7- 78
Antimony Bath (P) 9- 76
Electroless Deposition of Vanadium Alloys (P) 11- 77
Electroless Deposition of Vanadium Alloys (P) 11- 78
Wear-Resistant Electrodeposits (R) 12- 82

POLARIZATION

Relationship Between Polarization and Throwing Power in Plating Baths (A) 2- 78

POLISHING, BUFFING, SANDING, ETC.

Felt Polishing Belt (R) 1- 78
Belt Polisher (R) 1- 83
Polishing Device for Deeply Curved Surfaces (P) 2- 84
Abrasive Wheel (P) 2- 85
Gyrofinishing (P) 2- 86
Clinch Rings for Buffs (R) 2- 93
Buffing Wheel (P) 2-110
Combination Sisal and Cotton Buff (P) 2-110
Abrasive Belt Grinding (M) 2-131
Power Brushes (M) 2-132
Oscillating Sanding Machines (P) 3- 80
Backstand Idler (P) 3- 80
Abrasive Wheel (P) 3- 80
Automatic Air Tracking of Abrasive Belts (R) 3- 95
Grinding Wheel Data Book (M) 3-130
Belt Polishing (M) 3-130
Polishing Wheel (P) 4- 77
Method of Making Cloth Buffs (P) 4- 77
Abrasive Finishing Machine (P) 4- 78
Flexible Abrasive Wheel (P) 4- 78
Automatic Sunray Machine for Cookware Shells (R) 4- 91
Coated Abrasive Wheel (R) 4- 95
Rubberized Abrasives (M) 4-131
Conveyor Type Belt Polisher (R) 5-115
Sunray Machine (R) 5-119
Buffs (M) 5-162
Abrasive Wheel (P) 6- 80
Belt Polishing (P) 6- 81
Abrading Wheel (P) 6- 81
Deburring and Polishing Machine (P) 6- 82
Coated Abrasive Wheel (P) 6- 84
Buff (P) 6- 84
Automatic Polisher (R) 6- 88
Printed Circuit Finishers (R) 6- 92
Bench Type Abrasive Polisher (R) 6- 94
Polishing and Buffing Machine (M) 6-131
"Walrine" and "Removing the Green" (S) 7- 74
Abrasive Wheel (P) 7- 76
Treated Buffs (R) 7- 83
Abrasive Head (R) 7- 90
Flexible Deburring (M) 7-109
Flexible Shaft Polishers (M) 7-109
Belt Polisher (R) 8- 84
Contour Polisher (R) 8- 85
Contact Wheel (R) 8- 86
Abrasive Belt Wheel (R) 8- 90
Treated Buffs (R) 8- 91
Automatic Polishing Machines (M) 8- 92
Polishing Equipment & Supplies (M) 8- 93
Rubberized Abrasives (M) 8- 94
Zipper Polisher (P) 9- 77
Heavy Duty Sanders (R) 9- 89
Buffing and Polishing Machinery (M) 9-119
Treated Buff (R) 10- 92
Rotary Conveyor for Polishing Head Units (R) 10- 93
Flexible Grinding Wheel (R) 10- 94
Split Drum Sander (R) 10- 96
Coated Abrasives—Modern Tool of Industry (B) 10-118
Polishing Head (R) 11- 82
Spiral Wrap Abrasive Roll (R) 11- 86
Expanding Abrasive Wheel (R) 11- 89
Treated Buffs (R) 11- 92
Polishing Conveyor (R) 11- 92
Polishing and Buffing of Aluminum 12- 44
Buffing Wheel (P) 12- 73
Mechanical Finishing Machine (R) 12- 79
Power Brushes (M) 12- 91
Metal Center Buffs (M) 12- 92

POROSITY

Determination of Porosity of Chromium Plated Coatings (A) 2- 78
Study of the Functioning of Chromium Plating Baths by Radioactivity; Study of the Porosity of Deposits by the Aid of Radioactive Tracers; Estimation of Trivalent Chromium (A) 8- 80
Pores and Pitting of Plated Deposits 10- 64
Porosity Testing of Tin Coatings on Tinplate (A) 12- 74

POWER SUPPLIES

Power Rectifiers (M) 1- 97
Germanium Rectifiers (M) 1-116
Power Rectifiers (M) 2-121
Rectifier Power Conversion Systems (M) 3-123
Power Rectifiers (M) 3-130
Silicon Rectifier (R) 4- 82
Portable Plating Unit (R) 4- 85
Combination Tank Rheostat and Reversing Switch (R) 4- 90
Silicon Power Rectifiers (R) 4- 93
Silicon Rectifier (R) 6- 88
Adjustable Motor Base (R) 6-104
Rod Insulator (R) 7- 82
Polarity Reversing Rectifier (R) 7- 82
Silicon Plating Rectifiers (R) 7- 87
Power Supplies (M) 7-108
Speed Reducer (R) 8- 83
Selenium Rectifiers (M) 8- 92
Superimposing A.C. on D.C. (P) 9- 77
Power Supply (S) 10- 77
Current Rating Chart for Selenium Rectifiers (M) 10-114
Rectifiers (M) 10-115
Current Interrupter (M) 10-116
Plating Power Supply (R) 11- 87
Rectifiers (M) 11-114
Water-Cooled Silicon Rectifier (R) 12- 76
DC Power Supply (R) 12- 84
Rectifier Stack Conversion Kit (R) 12- 80

PRECIOUS METAL PLATING

Electroplating 22 Karat Gold-Silver Alloy 1- 55
Anti-Tarnish Coating on Silver (S) 1- 65
Silver Plating Titanium (P) 1- 72
Acid Gold Plating Process for Printed Circuits (R) 1- 78
Gold Plating (M) 1-115
Zinc in Silver Baths (S) 2- 75
Specification Gold Plating (S) 2- 75
Bright Gold Bath (P) 2- 80
Bright Gold and Silver Baths (P) 2- 82
Gold Bath (P) 8- 84
Silver Anode (P) 2- 85
Bright Silver Plating (P) 4- 78
Gold Plating (P) 5-106
Industrial Rhodium Plating (M) 5-162
Modern Silver Plating Practice 6- 61
Gold Plating Method (P) 6- 83
Rhodium Plating to Give Corrosion Protection (A) 6- 87
Platinum Plating Process (R) 6- 88
Rhodium Plating Practice (A) 7- 79
Plating Nickel Over Nickel (S) 9- 74
Gold Leaf-Electrolytic Preparation Methods (A) 9- 78
Silver Plating Bearings (S) 10- 78
Rhodium Concentrate (R) 10- 88
Blistering Around Fine Threaded Holes (S) 11- 76
Hardness and Wear Resistance of Plated Silver Coatings (A) 11- 80
Gold Finishing Lead Alloy (S) 12- 70
Alkaline Rhodium Baths (S) 12- 70
Plating on Beryllium-Copper (S) 12- 71

PRIMERS

An Introduction to Wash Primers 1- 58
An Introduction to Wash Primers 2- 61

PUMPS—See Filters and Pumps

RACKS AND RACK COATINGS

Plating Rack (P) 1- 70
Heat Fusible Plastisol (R) 1- 80
Titanium-Tipped Anodizing Racks 2- 65
Plating on Aluminum (S) 2- 76
Titanium Racks (R) 6- 96
Pressure Sensitive Teflon Tape (R) 6- 97
Electroplaters' Air Hammer (R) 6-104
Plastic Coating (M) 6-131
Plating Rack (P) 7- 78
Plating and Conveyor Racks (M) 7-108
Plating and Anodizing Rack Design 8- 62
Spring-Clamp Cathode Hook (R) 9- 84
Plating Rack (P) 11- 78
Plastisol Patch (R) 11- 82
Fixture for Metal Coating (P) 12- 72

RECOVERY AND PURIFICATION METHODS

Regeneration of Electrolytes Used for Electropolishing Steel—Removal of Iron (A) 1- 77
Etch Regenerating Process (R) 1- 81
Sludge in Strip Tank (S) 2- 76
Activated Carbon (M) 2-132
Chlorides in Copper Solutions (S) 4- 75
Zinc Removal from Nickel Baths (S) 5-101
Water—Its Use in the Plating Shop 7- 44
Electrolytic Purification (S) 7- 74
Iron in Acid Copper Solution (S) 9- 74
Rejuvenating Aluminum Pickles (P) 11- 78
Chemical Processes (M) 12- 90

RECTIFIERS—See Power Supplies

RINSING DRAGOUT

Stained Cadmium Plate (S) 1- 66
Bulk Rinsing 2- 70
Rinse Additive (R) 11- 86

SAFETY, PROCEDURES AND EQUIPMENT

Lined Gloves (R) 1- 85
Work Clothes (M) 1-116
Plastic Coated Gloves (R) 2- 89
Fire Detecting-Extinguishing Equipment (M) 2-121
PVC-Protected Aprons, Gloves, Garments (M) 2-122
Gloves (M) 2-122
Synthetic Safety Clothing (M) 2-122
Face and Eye Shields (M) 2-123
Coated Work Gloves (R) 4- 89
Fire Extinguisher (R) 4- 90
Dry Chemical Extinguisher (R) 5-124
Non-Spotting Skin Creams (R) 5-125
Face Mask (R) 5-127
Work Gloves (R) 5-131
Industrial Gloves (M) 6-132
Stainless Steel Shielded Gloves (R) 7- 89
Teflon Gloves (R) 8- 84
Lined Neoprene Gloves (R) 9- 82
Danger of Sparking (S) 10- 77

Disposable Clothing (R) 10- 90
Plastic Gloves (R) 11- 90

SOLVENTS

Cold Solvent (R) 3- 92
Epoxy Cold Solvent Stripper (R) 3-101

SPOTTING OUT

Spotting Out (S) 11- 75

STAINLESS STEEL AND CORROSION RESISTANT METALS

Pickling Stainless Steel (P) 4- 77
Fabricating Stainless Steel (M) 5-161
Chemical Polishing of V 2 A Stainless Steel by Gases (A) 7- 78
Coloring Stainless Steels (A) 7- 79
Stainless Steel Welding Stain Remover (R) 9- 82
Copper Sulfate Test for Stainless Steel (S) 10- 78
Electrolytic Pickling of Stainless Steels (A) 10- 81
Stainless Steel Pumps (R) 10- 99
Method of Pickling Titanium and Titanium Alloys (P) 11- 77
Plating on Titanium (P) 11- 79
Etching of Stainless Steels (A) 11- 80
Stainless Steel Conversion Coating (R) .. 11- 86
Treating Stainless Steel (P) 12- 73

STANDARDS AND SPECIFICATIONS

Specification Gold Plating (S) 2- 75
Government Specifications Catalog (M) 2-122
1957 Supplements to Book of ASTM Standards (B) 5-153
Troubles Caused by Too Severe Specifications for Plated Zinc Die Castings for Autos and Their Avoidance (A) 6- 86
A.S.T.M. Standards on Paint, Varnish, Lacquer and Related Products (B) 11-116
Electrodeposited Metallic Coatings (B) 12-101

STOP-OFFS

Silk Screening Resists (S) 3- 76
Stopoff Lacquer (R) 3- 86
Lead Foil Tape (R) 4- 90
Pressure Sensitive Teflon Tape (R) 6- 97
Flatback Paper Tapes (R) 10- 98

STRIPPING

Stripping Copper Alloys (P) 1- 68
Sludge in Strip Tank (S) 2- 76
Caustic Stripping Activator (R) 2- 90
Paint Remover Composition (P) 3- 79
Epoxy Cold Solvent Stripper (R) 3-101
Metal Stripper (M) 3-123
Stripping Chromium (S) 4- 75
Stripper for Vacuum Plating Rejects (R) 4- 87
Paint Stripper (R) 4- 91
Paint Remover for Hands (R) 5-125
Paint Stripping System (R) 6- 93
Paint Stripper (M) 6-132
Electrolytic Stripper (P) 7- 77
Stripper for Epoxy Coatings (R) 7- 87
Paint and Varnish Remover (R) 8- 86
Spray Booth Coating (R) 8- 87
How to Strip Paint (M) 8- 92
Hot Paint Spray Process (M) 8- 93
Chemical and Electrolytic Removal of Plated Coatings (A) 9- 78
Finish Stripper (R) 9- 98
Nickel Stripper (R) 10- 90
Paint Remover (P) 11- 77
Stripping Metallic Coatings 12- 60
Stripping Compound for Epoxy Resins (M) 12- 91

TANKS, LININGS AND FLOORING

Heat Fusible Plastisol (R) 1- 80
Settling Tanks (R) 3- 99
Coatings and Linings (R) 3-100
Acid-Proof Lining (M) 3-129
Etching for Hard Chromium (S) 4- 75
Transparent Polyvinyl Chloride (R) 4- 84
Portable Plating Unit (R) 4- 85
Filtration Tanks (R) 4- 92
Concrete Bonder (R) 4- 92
Acid-Proof Flooring (R) 4- 95
Polyethylene Tanks (R) 4- 98
Fiberglas Tanks (M) 4-132
Corrosion-Resistant Flooring (R) 5-117
Floor Resurfacer (R) 5-130
PVC Linings (M) 5-161
Floor Surfacer (R) 6- 98
Adhesive for Bonding Polyethylene to Steel (R) 6-102
Rubber Repair Kit (R) 9- 80
Corrosion-Resistant Materials (M) 9-119
Polyethylene Tanks (M) 10-115
Adhesive for Bonding New Concrete to Old (R) 12- 76
Carbon and Graphite for Chemical Applications (M) 12- 92

TESTING—ANALYSIS

Plating Test Cell (P) 1- 69
Thickness of Lead Deposits 2- 52
Determination of Porosity of Chromium Plated Coatings (A) 2- 78
Internal Stresses in Electroplated Copper (A) 2- 78
Mechanical Tests for Electroplated Deposits (A) 2- 79
Analysis of Plating Solutions (M) 2-132
Measuring Loads of Solid Flat Steel Parts 3- 70
Calculations for Chromic Anodize (S) 3- 76
Spectral-Analytical Method for the Determination of Thickne.s of Plated Coatings (A) 3- 81
Determination of the Coating Thickness of Anodized Films on Aluminum Alloys (A) 3- 82
Testing Instruments (M) 3-130
Factors Affecting Residual Stress in Electrodeposited Metals 4- 46
Research on Salt Spray Test Corrosion—Influence of the Test Part Shape (A) 4- 80
Test Kits for Chromium Plating Additive (R) 4- 82
Factors Affecting Residual Stress in Electrodeposited Metals 5- 82
Use of a Nickel Plating Bath as an Analytical Standard 5- 88
Dry Film Thickness Gage (P) 5-109
Coating Thickness Tester (R) 5-126
Abrasion Testing Instrument (R) 5-132
Corrosion of Zinc Plated Steel 6- 46
Factors Affecting Residual Stress in Electrodeposited Metals 6- 56
Determination of Aluminum in Electroplating Baths by Means of Radioactive Isotopes (A) 6- 86
Accelerated Corrosion Tests of Passivated Zinc Coatings (A) 6- 87
Internal Coating-Thickness Tester (R) 6- 91
Wet Film Gage (R) 6- 97
The Technique of Non-Destructive Metallographic Examination: Application to Hard Chrome Plating (A) 7- 81
Wear and Abrasion Testing Machine (P) 8- 79
Study of the Functioning of Chromium Plating Baths by Radioactivity: Study of the Porosity of Deposits by the Aid of Radioactive Tracers; Estimation of Trivalent Chromium (A) 8- 80
Cleaner Test Kit (R) 8- 83
Qualitative Analysis (B) 8-109
Coating Thickness Tester (P) 9- 77
Infra-Red Test Kit (R) 9- 91
Phosphating Analysis (M) 9-118
The Sulphur Dioxide Test 10- 49
The Use of a Coulometer 10- 71
Chromic Acid Anodizing (S) 10- 77
Copper Sulfate Test for Stainless Steel (S) 10- 78
Sampling a Plating Solution 11- 72
Measuring Stress in Deposits (P) 11- 79
Paper Thermometer (R) 11- 88
Aluminum Test in Bright Dips (R) 11- 90
Iron Analysis in Chromium Solutions 12- 64
Technical Control Data 12- 65
Cyanide Analysis in Wastes (R) 12- 71
Testing Aluminum Deposits (P) 12- 72
Plating Adhesion Tester (P) 12- 73
Porosity Testing of Tin Coatings on Tinplate (A) 12- 74
Corrosion Test Cabinet (R) 12- 81

THEORETICAL

Mechanism of Chromium Plating (A) 1- 74
Physical Fundamentals and Characteristics of Supersonic Vibrations (A) 1- 77
Internal Stresses in Electroplated Copper (A) 2- 78
Residual Stresses in Electroplated Deposits (A) 2- 79
Reactions Occurring During Electrolytic Reduction of Chromic Acid Containing Sulfuric Acid (A) 3- 83
Factors Affecting Residual Stress in Electrodeposited Metals 4- 46
Science for Electroplaters 4- 68
Factors Affecting Residual Stress in Electrodeposited Metals 5- 82
Science for Electroplaters 5- 93
Factors Affecting Residual Stress in Electrodeposited Metals 6- 56
Science for Electroplaters 6- 76
Handbook of Lattice Spacings and Structures of Metals and Alloys (B) 6-120
Factors Affecting Residual Stress in Electrodeposited Metals 7- 52
Science for Electroplaters 7- 70
Science for Electroplaters 8- 73
Concentration Changes in Electrode Films in Chromium Baths and the Mechanism of Deposition (A) 8- 80
Study of the Functioning of Chromium Plating Baths by Radioactivity: Study of the Porosity of Deposits by the Aid of Radioactive Tracers; Estimation of Trivalent Chromium (A) 8- 80
Possibilities of Improvement of Cathodic Efficiency and Covering Power in Chromium Plating Baths (A) 8- 81
Science for Electroplaters 9- 67
Mechanism of the Electrodeposition of Chromium (A) 9- 78
Phenomena Occurring During Electrolytic Reduction of Aqueous Sulfate-Containing Chromic Acid Solutions (A) 9- 79
Science for Electroplaters 10- 74
Science for Electroplaters 11- 73
Science for Electroplaters 12- 66
Mechanism of the Leveling Effect in Nickel Plating (A) 12- 75

THROWING POWER

Relationship Between Polarization and Throwing Power in Plating Baths (A) 2- 78
Influence of the Impurities of Bright Nickel Plating Baths on the Throwing Power of Chromium Plating Baths (A) 7- 81
Possibilities of Improvement of Cathodic Efficiency and Covering Power in Chromium Plating Baths (A) 8- 81
Effects of Impurities in a Bright Nickel Bath on the Covering Power of a Chromium Bath 12- 46

TIN PLATING

Applications of Electrotinned Steel Sheet (A) 4- 81
Sealing Tin Plate (S) 5-101
"Fused" Tin (S) 5-101
Treatitng Tin Surfaces (P) 7- 77
Immersion Tin (P) 8- 78
Structure of Electroplated Tin Coatings (A) 8- 81
Reflow Oils for Tin Plate (R) 8- 83
Strip Electrotinning (P) 9- 77
Greville Process of Hot Dip Tinning (A) 10- 82
Porosity Testing of Tin Coatings on Tinplate (A) 12- 74
Developments and Trends in Electrotinning Lines for Tinplate Manufacture (A) 12- 75

TUMBLING AND BARREL FINISHING

Barrel Finishing Machines (R) 1- 78
Tumbling Media (M) 2-132
Barrel Finishing System (R) 3- 87
Coloring and Burnishing Compound (R) .. 3- 90
Barrel Finishing Machines (R) 3- 94
Automatic-Turntable Barrel Finishing System (R) 3- 95
Compounds for Barrel Finishing (M) 3-129
Barrel Finishing (M) 3-129
Tumbling Barrel (P) 4- 79
Significance of Barrel Polishing in the Surface Treatment of Metals (A) 4- 80
Abrasive Finishing Compound (R) 4- 86
Multiple-Barrel Finishing Unit (R) 4- 88
Vibrating Barrel Finisher (R) 4- 97
Combination Tumbling-Plating Barrel (R) 5-118
Barrel Finishing Machine (R) 5-119
Burnishing Compounds (R) 5-120
Deburring Machines (M) 5-161
Stainless Steel Burnishing Barrel (R) 6-103
Process Cards (M) 6-131
Metal Finishing Process (R) 7- 84
Barrel Finishing Machinery (M) 7-108
Barrel Finishing Media (M) 7-109
Barrel Finishing Media (R) 9- 80
Barrel Finishing Machine (R) 9- 84
Barrel Finishing Machine (R) 9- 88
Neutralizer Compound (R) 9- 88
Barrel Finishing Compounds (R) 9- 90
Barrel Finishing Equipment (R) 9- 95
Barrel Finishing Media (M) 9-118
Barrel Finishing (M) 9-119
Barrel Finishing Machine (R) 10- 95
Chip Grader and Parts Separator (R) 10- 97
Abrasive Blast Barrel (R) 11- 91
Barrel Finishing Compounds (M) 11-113
Barrel Finishing Media (M) 11-114
Barrel Finishing Machine (M) 11-115
Barrel Finishing Machines (M) 11-115
Barrel Finishing Machine (M) 12- 92

ULTRASONICS

Ultrasonics in Metal Cleaning Processes (A) 1- 75
Physical Fundamentals and Characteristics of Supersonic Vibrations (A) 1- 77
Portable Ultrasonic Cleaning Unit (R) 1- 85
Ultrasonic Cleaning (M) 1-116
Test Run of a Supersonic Cleaning and Degreasing Plant (A) 2- 77
Action of Ultrasonic Vibrations on Metal Plating Processes (A) 2- 78
Ultrasonic Degreaser (P) 2- 85
Ultrasonic Cleaner (R) 2- 86
Ultrasonic Metal Cleaning Practice (A) .. 3- 81
Ultrasonic Cleaner (R) 3- 88
Ultrasonic Equipment (R) 3- 93
Ultrasonic Cleaners (M) 3-120
Large Scale Ultrasonic Cleaner (R) 4- 94
Ultrasonic Cleaner (R) 5-128
Ultrasonic Cleaners (R) 5-129
Ultrasonic Cleaning System (P) 6- 82
Laboratory Size Ultrasonic Units (R) 6- 99
Ultrasonic Cleaners (M) 7-108
Ultrasonic Cleaning (M) 7-109
Ultrasonic Degreaser (R) 8- 86
Ultrasonic Processing Tank (R) 8- 87
Ultrasonic Cleaner (R) 9- 87
500-Watt Ultrasonic Cleaner (R) 10- 91
5-Gallon Ultrasonic Cleaner (R) 10- 95
Ultrasonic Cleaning (P) 11- 78
Ultrasonic Equipment (M) 11-114
Ultrasonic Cleaner (R) 12- 82

VACUUM DEPOSITION OF METALS

High Vacuum Pumps (M) 2-132
Production-Size High Vacuum Evaporator (R) 3- 97
High Vacuum Equipment (M) 3-121
Vacuum Metalizing (M) 3-129
Stripper for Vacuum Plating Rejects (R) 4- 87
Organic Coating for Vacuum Metalizing (R) 4- 95
Vacuum Metalizer (R) 4- 96
Vacuum Plating (P) 5-106
Vacuum Metalizing on Polyethylene (R) .. 5-124

Moisture Trap for Vacuum Metalizing (R) 6- 90
High Vacuum Valves (M) 6-131
Vacuum Metalizing Unit (R) 7- 89
An Introduction to Vacuum Metalizing 8- 54
Vacuum Metalizing (P) 8- 78
Portable Vacuum Pumping System (R) 8- 87
Vacuum Metalizing Coatings (M) 9-117
Rotary Vacuum Pumps (R) 10- 90
Production Vacuum Coater (R) 10- 96
Booster Vacuum Pumps (R) 11- 94
Vacuum Metalizing Coils (M) 11-115
Cathode Sputtering (S) 12- 70
High Vacuum Diffusion Pump (R) 12- 83

VENTILATION AND EXHAUST SYSTEMS

Belt-Driven Exhaust Fans (R) 1- 81
Dust Collector (R) 2- 88
Air Filter (R) 2- 91
Air Make-up Unit (R) 2- 93
Spray Guns and Booths (M) 3-121
Fume Washer (M) 3-132
Wet Type Gas Scrubbing Systems (R) 3- 91
Solution Surface Blanket (R) 3- 96
Plastic Fume Scrubber (R) 3-100
Mechanical Draft Fan (M) 3-121
Catalytic Fume Oxidation (M) 3-122
Fume Scrubbers (M) 3-130
Spray Booth (P) 4- 77
Spray Booth (R) 4- 98
Water Treatment for Wet Spray Booths (M) 4-131
Exhaust Ducts (M) 4-132
Finishing Systems (M) 4-132
Gas Scrubbing Tower (R) 5-118
Acid Fume Depressant (R) 5-126
Extension Shaft Fans (R) 5-129
Heating, Ventilating (M) 5-161
Ventilating Fans (R) 6- 98
Centrifugal Dust Collectors (R) 6-102
Centrifugal Dust Precipitator (M) 7-109
How Much Air? 8- 53
Unit Dust Collectors (R) 9- 97
Fans & Blowers (M) 9-118
Rotary Blowers (M) 9-119
Dehumidification (M) 9-119
Giant Plastic Fan (R) 10- 90
Acid Mist and Vapor Collector (R) 10- 96
Air Moving Equipment (M) 10-115
Dry and Water-wash Exhaust Booths (M) 10-116
Exhausting Spray Booths (S) 11- 75
Wet-Wall Versus Dry-Wall Spray Booth (S) 11- 75
All Plastic Fume Washer (R) 11- 89

WASTES, TREATMENT AND DISPOSAL OF

Science for Electroplaters 1- 61
Pickling Waste Treatment (P) 1- 71
Science for Electroplaters 2- 71
Science for Electroplaters 3- 72
Settling Tanks (R) 3- 99
High Capacity Chlorinator (M) 3-120
Pickling Waste Treatment (P) 5-103
Pickling Waste Recovery (S) 7- 74
Chlorinator (R) 7- 88
Water and Waste Control for the Plating Shop (B) 7-102
Waste Treatment (M) 7-108
Automatic Chlorinator Control (R) 8- 86
Ion Exchange Regeneration (M) 8- 93
Recovery or Disposal of Plating Wastes? 9- 46
Trends in Waste Disposal 11- 54
Plating Waste Treatment (M) 11-113
Cyanide Analysis in Wastes (S) 12- 71
Dialysis System for Acid Separation (R) 12- 80

WATER

Science for Electroplaters 4- 68
Demineralizer (R) 4- 93
Monitoring System for Automatic Demineralizers (R) 5-114
Demineralization (M) 5-161
Water Treatment (M) 5-162
Water—Its Use in the Plating Shop 7- 44
Water and Waste Control for the Plating Shop (B) 7-102
Ion Exchange Regeneration (M) 8- 93
Water Conditioning (M) 11-115
Chemical Processes (M) 12- 90

ZINC PLATING

Addition Agent for Acid Zinc Bath (P) 2- 80
Bright Dipping Zinc (S) 3- 76
Comparison Between Hot-Dip Zinc and Zinc Plating (A) 3- 82
Cadmium and Zinc Plating (S) 4- 76
Zinc Brighteners (R) 4- 88
Cadmium vs. Zinc (S) 5-101
Corrosion of Zinc Plated Steel 6- 46
Accelerated Corrosion Tests of Passivated Zinc Coatings (A) 6- 87
Zinc and Cadmium for Corrosion Protection (A) 7- 80
Chromate Finish for Zinc (R) 8- 88
Electrodeposition of Bright Zinc, Copper, or Nickel (P) 11- 79
Brighteners for Copper, Zinc and Nickel (P) 12- 72
Passivation of Zinc Coatings in Chromate Solutions (A) 12- 74

INDEX TO AUTHORS

Ananiatis, Nicholas—Cleaning and Plating Steel Assemblies 6- 65
Beach, Warren—Interest Grows in Hot Spray Painting 3- 63
Beck, E. S.—An Introduction to Wash Primers 1-58, 2- 61
Science for the Coatings Technologist 4-52, 5-58, 6-53, 7-56, 9-64, 10- 56
Benson, Lamont J.—Polishing and Buffing of Aluminum 12- 44
Bowen, Henry D., Jr.—New Vinyl Paint Facilities at Poughkeepsie IBM 4- 59
Cafferty, A. G.—Electroplating 22 Karat Gold-Silver Alloy 1- 55
Cagle, A. W.—Western Electric's Modern Metal Finishing Plant 8- 48
Cocks, Eric H.—Automatic Painting of Conduit Interiors 11- 63
Edwards, J.—The Sulphur Dioxide Test 10- 49
Field, George C.—Measuring Loads of Solid Flat Steel Parts 3- 70
Foulke, Dr. D. Gardner—Trends in Waste Disposal 11- 54
Gabrielson, Gunner—Thickness of Lead Deposits 2- 52
Goldrath, Bert—New Painting Facilities Effect Production Economies 10- 61
Greenspan, Lawrance—Modern Silver Plating Practice 6- 61
Hall, Nathaniel—Technical Developments of 1957 1- 40
Harr, R. E.—Electroplating 22 Karat Gold-Silver Alloy 1- 55
Hirasawa, Yoshio—New Japanese Hard Chromium Plant 2- 55
Jerczyk, Edward R.—Applications for Alkaline Descaling Cleaners 10- 46
Jumer, John F.—Electropolishing—What, How and Why 8-44, 9-60, 10- 67
Keating, R. J.—Recovery or Disposal of Plating Wastes? 9- 46
Kentta, G. R.—Plating Room Layout 9- 52
Knanishu, Jacob—How Grit Blasting Improves Phosphate Coatings 3- 57
Kraus, Henry—Plating and Anodizing Rack Design 8- 62
Kushner, Dr. Joseph B.—Factors Affecting Residual Stress in Electrodeposited Metals 4-46, 5-82, 6-56, 7- 52
Ljunggren, Kurt—Thickness of Lead Deposits 2- 52
Lorking, K. F.—Electropolishing Copper, Brass and Aluminum 3- 64
Mahlstedt, Henry—Barrel Chromium Plating Continuous Bulk Processing 2- 58
Marino, Daniel A.—Organic Finishing Developments of 1957 1- 50
New Water Soluble Baking Paint Makes its Debut 11- 70
Missel, L.—Thermal Shock Resistant Nickel Plating on Copper 9- 49
Mohler, J. B.—Bulk Rinsing 3- 70
Strike Cleaning 3- 69
Chromium Plating Thickness 4- 58
Use of a Nickel Plating Bath as an Analytical Standard 5- 88
Design of a Plating Line 7- 65
How Much Air? 8- 53
The Use of a Coulometer 10- 71
Sampling a Plating Solution 11- 72
Stripping Metallic Coatings 12- 60
Technical Control Data 13- 65
Oderkerken, Dr. J. M.—Pores and Pitting of Plated Deposits 10- 64
Pinner, R.—Institute of Metal Finishing Holds 1958 Conference 6- 66
Ritt, P. E.—Firm Adherent Plating for Aluminum 1- 53
Rousselot, G. E. and R. H.—Effects of Impurities in a Bright Nickel Bath on the Covering Power of a Chromium Bath 12- 46
St. Amand, E. J.—Western Electric's Modern Metal Finishing Plant 8- 48
Salka, A.—Iron Analysis in Chromium Solutions 12- 64
Sanbostre, Dr. E. B.—Electroforming with Plating Cells 11- 62
Scharnberg, John—An Introduction to Vacuum Metalizing 8- 54
Self, M. A.—An Introduction to Vacuum Metalizing 8- 54
Serota, L.—Science for Electroplaters 1-61, 2-71, 3-72, 4-68, 5-93, 6-76, 7-70, 8-73, 9-67, 10-74, 11-73, 12- 66
Sigman, Donald A.—Flexibility and Labor Reduction Feature New Plating Department 3- 65
Spencer, Lester F.—Mechanical Springs—Materials, Finishes and Embrittlement 2- 66
Chemical Polishing 3-52, 4- 62
Water—Its Use in the Plating Shop 7- 44
Organic Finishing of Aluminum and its Alloys 8- 58
Finishing Zinc Base Die Castings 11-58, 12- 56
Spooner, Dr. R. C.—Light-Fastness of Organic Dyes on Anodized Aluminum 11- 48
Starr, John—Organic Coatings for Pest Control 6- 64
Steiger, A. J.—Gold-Dyed Aluminum Used in Russian Watches 2- 54
Spray Cleaning, Pickling and Phosphating 3- 48
Cold Chromium Plating In Russia 4- 56
Automation Painting in Russian Machine Tool Manufacturing 12- 51
Tinsley, Ervin C.—Phosphating Treatments 4-71, 5-97, 6-72, 7-66, 8-70, 9-71, 10- 72
Weed, J. Arthur—Reducing Spray Painting Costs 9- 58
Use of Automatic Machinery in the Spray Painting Field 11- 68
Pumps and Their Uses in Spray Painting 12- 54
Withers, J. C.—Firm Adherent Plating for Aluminum 1- 53
Wolff, Russell H.—Corrosion of Zinc Plated Steel 6- 46

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Other outstanding values in stock.

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ALL OF THE EQUIPMENT LISTED BELOW IS FULLY RECONDITIONED AND GUARANTEED IN STOCK

POWER EQUIPMENT

1—H-VW-M Mtr. Gen. 750/A—8 V.
1—American Giant 750 amps. 6 volts
3—Udylite rectifiers 1500/750 amp. 6/12 V.
R-A 500 amp., 6 V. with control.
G. E. 500 amps. 6 volts with control.
Rapid 300 amps. 6 volts with control.
Udylite 500 amps. 6 volts with control.

SEMI-AUTOMATIC PLATING MACHINES

5—From 12' to 32' long for nickel and cyanide.

PLATING BARRELS

Daniels #3.
3—Lasalco steel 36 x 18 Lucite cylinder.
1—Lasalco rubber lined 30 x 15.
1—H-VW-M steel 36 x 18.
1—Udylite steel—42 x 15.
2—Udylite multi-purpose barrel — hard rubber cylinder.
1—Belke oblique plater.

FILTERS

Industrial, Alsop, Sethco — all sizes — nickel and cyanide solutions.

TUMBLING BARRELS

5—Abbott barrels.
#2H Baird poliaction Tumbler.
10—Baird barrels 2C tilting type.
8—Henderson barrels 5A tilting type.
4—Globe barrels.

POLISHING MACHINES

1—Production Machine #101 — 7½ H.P.
4—#101 Tandum 15 H.P.
2—Production Machine #484-2.
2—Divine Model VM-10 — 10 H.P.
2—L'Hommedieu 5 H.P. variable speed.
15—Holland 5 H.P. — 7½ H.P. — 10 H.P.
1—Acme L-82 — 7½ H.P.
Gardener 5 H.P. — 7½ H.P.
6—Divine Idlers.

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Ronci R100.
2—Barrett centrifugal dryers.
1—H-VW-M centrifugal dryer.
2—Kreider #12 steam explosionproof mtrs.

BOILERS

Kane gas fired 20 H.P., 7½ H.P.

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1—Detrex alkaline belt washer.
1—Philips electric degreaser.
1—Blakeslee pump type washer.
Blowers and motors—multivain (fume) paddle wheel (dust).
1—Blakslee washer.

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300—All sizes — all linings.

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400—Assorted plating rheostats, double pole reversing switches, from 10 amp. up to 5000 amps.

300—Assorted size wood, steel, rubber, plastic, lead lined and stainless tanks up to 30 ft. long.
300—Assorted buffing and polishing machines from 1 HP to 50 HP single and double end spindles, including some variable speed types.
50—Assorted Plating Barrel Units, Standard Makes for all solutions.

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100—Sturgis, Roto Finish, Baird, Crown, Belke, Abbott, Henderson and other makes of tumbling, cleaning and burnishing barrels.

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5—Industrial Filters, RDR-2, 36 x 3630, for nickel, complete.
100—Various sizes rectifiers from 25 amp. to 5000 amps. Selenium, Germanium, all complete with controls.
90—Various size Generator sets from 50 to 10,000 amps, Chandeysson, Hanson Van Winkle Munning, Bogue and other standard makes, all complete with panel boards, starters, etc. voltage range 2 volts up to 100 volts, for all purposes.

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(CAN BE SEEN ON FOUNDATIONS)

POWER UNIT:
1—Chandeysson 40 KW anodizing motor generator. Rated 1000 amperes @ 40 volts continuous duty. Generator is shunt wound, type NPT 18.5, Serial #30639. Generator is direct connected to Synchronous Motor, rated 60 HP, 3/60, 220. Self contained exciter.

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Complete starting equipment for the above listed motor. Also panel board and controls for the DC operation of the generator.

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1—Stainless Steel tank (Nitric Acid) complete with stainless steel coils and stainless steel exhaust pipe. Size 58" Wide x 12' Long x 60" Deep.
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1—Stainless Steel tank (Acid). Size 3' Wide x 4' Long x 4' Deep.

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2—Anodizing tanks, of steel construction, plastic lined. Complete with 7½ HP motor driven blowers, Foxboro temperature controllers and recorders. These tanks are 80" deep. They are "L" shaped, being 42" wide x 24' long with a 6' x 6' "L" at one end.
2—Anodizing tanks (pit type) of steel construction, plastic lined, complete with steam coils. Size 7' Wide x 7' Long x 8' Deep.

RINSE TANKS:
1—Water rinse tank. Steel construction with stainless steel lining. Size 3' Wide x 4' Long x 4' Deep.
1—Water rinse tank. Steel construction. Size 5' Wide x 5' Deep x 12' Long.

DRYING TANKS:
1—Drying tank of steel construction, (wood floor). Fully insulated, equipped with modine motor driven steam heaters. Size 5' Wide x 5' Deep x 12' Long.
1—Drying tank of steel construction, fully insulated. Equipped with modine motor driven steam heaters. Size 13' Wide x 16' Long x 6' Deep.

CLEANING EQUIPMENT:
1—Detrex Degreaser, model VA800, equipped for steam heat, with two motor driven blowers. This degreaser has Leeds and Northrup controller with 3/60/220/440 push button control. Size 3' x 8' x 16'.
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2—Hammond Machinery Co. polishing lathes, with 5 HP 3/60, 220/440 motors.

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2— 12 Volt— 7,500 Amps.
1— 9 Volt— 7,500 Amps.
1— 6 Volt— 6,000 Amps.
2— 8 Volt— 3,000 Amps.
1— 6 Volt— 3,000 Amps.
1—6/12 Volt— 1,500 Amps.
1—9/18 Volt— 1,500 Amps.

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1—Rapid 750 amperes @ 12 d.c. volts.
1—Rapid 100 amperes @ 12 volts.
6—Selenium 125 amperes @ 12 d.c. volts.
1—Selenium 150 amperes @ 12 d.c. volts.
1—Rapid 200 amperes @ 6 d.c. volts.
1—Hobart 200 amperes @ 12 d.c. volts.
1—G.E. 300 amperes @ 6 d.c. volts.
5—Selenium 500 amperes @ 6 d.c. volts.
10—Udylite 750 amperes @ 12 d.c. volts.
1—Richardson Allen 1000 amps. @ 6 d.c. v.
1—H.V.W.M. 1250 amperes at 12 d.c. volts.
10—Udylite 1500 amperes @ 6 d.c. volts.
2—Rapid 2000 amperes at 6 d.c. volts.
1—H.V.W.M. 2500 amperes @ 6 d.c. volts.
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100	80/90	Reliance
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200	7½	Chandeysson
200	65	G. E.
200	7½	Hobart
300	7½	Hobart
400	60/60	G. E.
400	6	H-V-W
750 (Twin)	6	H-V-W
940	32	Elec. Prod.
1000/500	6/12	Chandeysson
1500	15	Star
1500	30/50	Century
1500	40/65	G. E.
1500	65	Westinghouse
1500	70	Century
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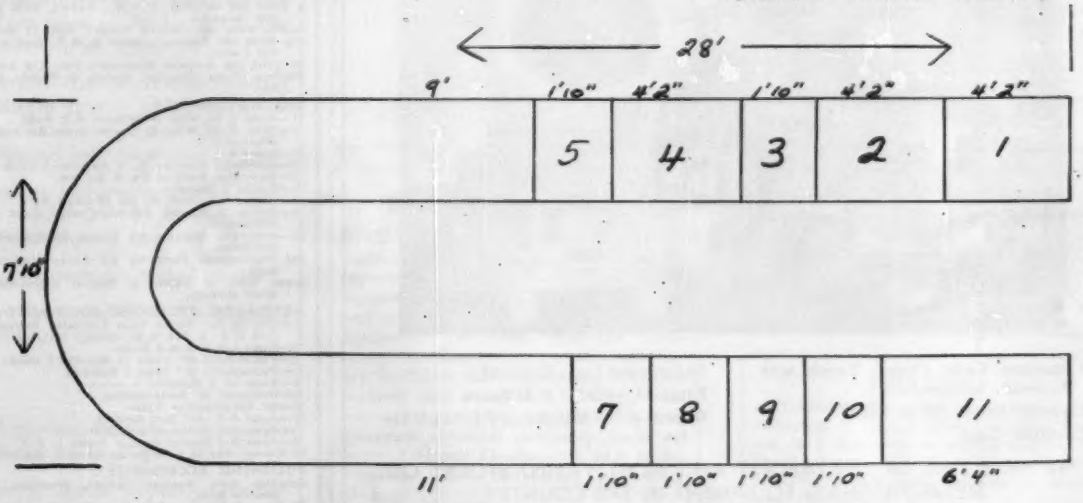

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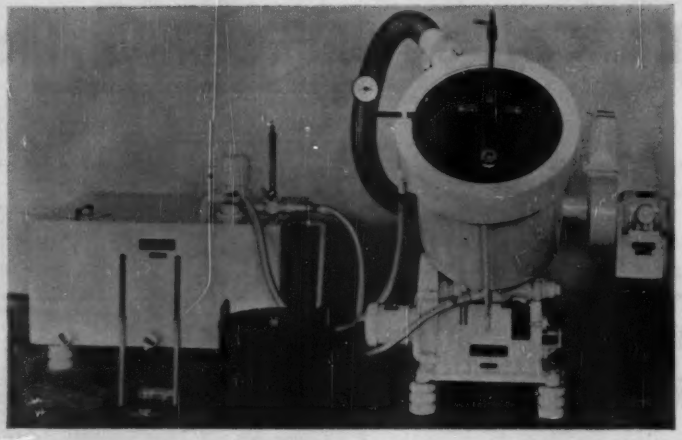

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Abbey Process Automation, Inc. 35
37-01 48th Ave., Long Island City 1, N. Y.
Abrasive Products, Inc. 79
So. Braintree 85, Mass.
Acme Manufacturing Co. 31
1400 E. 9 Mile Rd., Detroit 20 (Ferndale), Mich.
Agate Lacquer Mfg. Co. 95
11-13 43rd Rd., Long Island City 1, N. Y.
Alert Supply Co.
2041 S. Davie Ave., Los Angeles, Calif.
Allied Research Products, Inc. 16
4004 E. Monument St., Baltimore 5, Md.
Alsop Engineering Corp.
1311 Bright St., Milldale, Conn.
Alvey-Ferguson Co.
505 Disney St., Cincinnati 9, Ohio
American Brass Co. 80, 81
Waterbury 20, Conn.
American Buff Co. 98
2414 S. LaSalle St., Chicago 16, Ill.
Ampco Metal, Inc.
1945 So. 38th St., Milwaukee 46, Wis.
Apothecaries Hall Co.
22 Benedict St., Waterbury 20, Conn.
Armitage & Co., John L. 85
245 Thomas St., Newark 5, N. J.
Atlas Mineral Products Co.
Mertztown, Pa.
Bacon Felt Co. 32
437 W. Water St., Taunton, Mass.
Baird Machine Co.
Stratford 9, Conn.
Baker Bros., Inc. 115, 116
564 E. First St., So. Boston 27, Mass.
Baker Co., Alan 116
180 Sylvester Rd., South San Francisco, Calif.
Baker Co., The M. E. 113
25 Wheeler St., Cambridge 38, Mass.
Barker Bros., Inc. 93
1660 Summerfield St., Brooklyn 27, N. Y.
Beam-Knedel Co. 101
195 Lafayette St., New York 12, N. Y.
Beck Equipment Co. 96
3352 W. 137th St., Cleveland 11, Ohio
Belke Manufacturing Co. 17
947 N. Cicero Ave., Chicago 51, Ill.
Better Finishes & Coatings, Inc. 89
268 Doremus Ave., Newark 5, N. J.
Blakeslee & Co., G. S.
1844 S. Laramie Ave., Chicago 50, Ill.
Brucar Equipment & Supply Co. 115
602-604 20th St., Brooklyn, N. Y.
Chandeysson Electric Co.
4074 Bingham Ave., St. Louis 16, Mo.
Chemical Corp., The 69
58 Waltham Ave., Springfield, Mass.
Churchill Co., Inc., Geo. R.
Hingham, Mass.
Ciba Co., Inc.
627 Greenwich St., New York 14, N. Y.
Cincinnati Cleaning & Finishing Machinery Co.
2027 Hageman St., Cincinnati 41, Ohio
Circo Equipment Co.
51 Terminal Ave., Clark Twp. (Rahway), N. J.
Clair Manufacturing Co., Inc.
Olean, N. Y.
Cleveland Process Co. 78
1965 E. 57th St., Cleveland 3, Ohio
Clinton Supply Co. 114
112 S. Clinton St., Chicago 6, Ill.
Cohn Mfg. Co., Inc., Sigmund 32
121 S. Columbus Ave., Mt. Vernon, N. Y.
Columbia-Southern Chemical Corp.
One Gateway Center, Pittsburgh 22, Pa.
Crown Rheostat & Supply Co. 20
1965 Pratt Blvd., Elk Grove Village, Ill.
Davies Supply & Mfg. Co. 97
4160 Meramec St., St. Louis 16, Mo.
Davis-K Products Co.
135 W. 29th St., New York 1, N. Y.
Dean Thermo-Panel Coil Div., Dean Products, Inc. 101
613 Franklin Ave., Brooklyn 38, N. Y.
Deering, Milliken & Co., Inc. 91
1045 Sixth Ave., New York 18, N. Y.
Detrex Chemical Industries, Inc.
Box 501, Detroit 32, Mich.
DeVilbiss Co., The 8, 9
Toledo 1, Ohio
Dixon & Rippel, Inc. 100
Box 116, Saugerties, N. Y.
Dow Chemical Co., The 6, 7
Midland, Mich.
Dresser Electric Co. 36
2705 Wight St., Detroit 7, Mich.
Du Pont de Nemours & Co., E. I.
Wilmington 98, Del.
Egyptian Lacquer Mfg. Co.
Box 444, Newark 1, N. J.
Electro-Glo Co.
1430 So. Talman Ave., Chicago 8, Ill.
Electrochemical Products Co. 102
2800 W. Glendale Ave., Milwaukee 9, Wis.
Engelhard Industries, Inc., Chemical Div.
113 Astor St., Newark 2, N. J.
Enthone, Inc. 3
442 Elm St., New Haven, Conn.
Federated Metals Div., American Smelting & Refining Co. 13
120 Broadway, New York 5, N. Y.
Formax Mfg. Corp. 97
3171 Bellevue, Detroit 7, Mich.
G. S. Equipment Co. 88
15585 Brookpark Rd., Cleveland 10, Ohio
Glo-Quartz Electric Heater Co., Inc.
Willoughby, Ohio
Graver Water Conditioning Co. 14
216 W. 14th St., New York 11, N. Y.
Gumm Chemical Co., Inc., Frederick Inside Front Cover
538-542 Forest St., Kearny, N. J.
Hamilton Emery & Corundum Co. 100
Chester, Mass.
Hammond Machinery Builders, Inc.
1601 Douglas Ave., Kalamazoo 54, Mich.
Hammond Solvents Recovery Service
241 Brunswick St., Hammond, Ind.
Handy & Harman 90
82 Fulton St., New York 38, N. Y.
Hanson-Van Winkle-Munning Co.
Matawan, N. J.
Hardwood Line Mfg. Co. 102
2022 N. California Ave., Chicago 47, Ill.
Harrison & Co., Inc.
487 Groveland St., Haverhill, Mass.
Harshaw Chemical Co., The 30
1945 E. 97th St., Cleveland 6, Ohio
Heatbath Corp.
Springfield 1, Mass.
Heil Process Equipment Corp.
12901 Elmwood Ave., Cleveland 11, Ohio
Henderson Bros. Co. 84
136 S. Leonard St., Waterbury, Conn.
Holland & Sons, Inc., J. 113
485 Keap St., Brooklyn 11, N. Y.
Hooker Chemical Corp. 39
1303 Union St., Niagara Falls, N. Y.
Hull & Co., Inc., R. O.
1300 Parsons Ct., Rocky River 16, Ohio
Ideal Chemical Co. 116
1499 Dean Dr., So. Euclid 21, Ohio
Illinois Water Treatment Co. 87
840 Cedar St., Rockford, Ill.
Industrial Filter & Pump Mfg. Co. 28
5906 Ogden Ave., Chicago 50, Ill.
Industrial Instruments, Inc.
89 Commerce Rd., Cedar Grove, N. J.
International Rectifier Corp. 26, 27
1521 E. Grand Ave., El Segundo, Calif.
Ionic Electrostatic Corp. 24
105-119 Monroe St., Garfield, N. J.
Jelco Finishing Equipment Corp.
153 E. 26th St., New York 10, N. Y.
Kocour Company 96
4802 S. St. Louis Ave., Chicago 32, Ill.
Koehler Instrument Co., Inc.
168-56 Douglas Ave., Jamaica 33, N. Y.
Kosmos Electro-Finishing Research, Inc. 99
140 Liberty St., Hackensack, N. J.
Kushner, Dr. Joseph B. 100
2509 Washington Ave., Evansville, Ind.
Land Inc., L. J. 114
P. O. Box 689, Weehawken, N. J.
Lasalco, Inc. 40
2820-38 Lasalle St., St. Louis 4, Mo.
Lea Mfg. Co. 34A
16 Cherry Ave., Waterbury 20, Conn.
Lea Michigan, Inc.
14066 Stansbury Ave., Detroit 27, Mich.
Lea-Ronal, Inc. 34B
139-20 109th Ave., Jamaica 35, N. Y.
Lewis Welding & Engineering Corp.
106 Northfield Rd., Bedford, Ohio
L'Hommedieu & Sons Co., Chas. F. 5
4521 Ogden Ave., Chicago, Ill.
Lindale Equipment & Supply Corp. 113
504 Smith St., Brooklyn 31, N. Y.
Lowe Brothers Co., The 22
Dayton 2, Ohio
Macerr, Inc.
2543 Boston Rd., Bronx 67, N. Y.
MacDermid, Inc. Back Cover
Waterbury 20, Conn.
Magnuson Products, Inc.
50 Court St., Brooklyn 1, N. Y.
Manhattan Rubber Div., Raybestos-Manhattan, Inc. 88
6 Willett St., Passaic, N. J.
Meaker Company, The
1629 S. 55th Ave., Chicago 50, Ill.
Metal & Thermit Corp. 23, 42
Rahway, N. J.
Michigan Chrome & Chemical Co.
8615 Grinnell Ave., Detroit 13, Mich.
Miller Corp., Harry
4th & Bristol Sts., Philadelphia 40, Pa.
Motor Repair & Mfg. Co., The 115
1555 Hamilton Ave., Cleveland 14, Ohio
Murray-Way Corp.
P. O. Box 180, Maple Rd. E., Birmingham, Mich.
National Polymer Products, Inc.
Reading, Pa.
Nazar Rubber Co., The
2727 Avondale, Toledo 7, Ohio
New Holland Machine Co. 99
New Holland, Pa.
N. J. Thermex Co., Inc.
535 Bergen St., Harrison, N. J.
Northwest Chemical Co. 10
9310 Roselawn Ave., Detroit 4, Mich.
Norton Co. 12
1 New Bond St., Worcester 6, Mass.
Oakite Products, Inc. 4
18 Rector St., New York 6, N. Y.
Octagon Process, Inc. 100
15 Bank St., Staten Island, N. Y.
Pecker Machine Co.
456 Center St., Meriden, Conn.
Perk Chemical Co.
8074 Military Ave., Detroit 4, Mich.
Pennsalt Chemicals Corp.
3 Penn Center Plaza, Philadelphia 2, Pa.
Pesco Plating Equipment Corp. 116
75 Wythe Ave., Brooklyn 11, N. Y.
Pfizer & Co., Inc., Chas.
630 Flushing Ave., Brooklyn 6, N. Y.
Phelps Dodge Refining Corp. 86
300 Park Ave., New York 22, N. Y.
Plating Products, Inc. 92
1509 N. Washington, Kokomo, Ind.
Potter Paint Co., Inc. 34
21 Crawford St., Cortland, N. Y.
Promat Div., Poor & Co. 34
851 S. Market St., Waukegan, Ill.
Quartz Radiation Corp.
54 Summer Ave., Newark, N. J.
Ramco Equipment Corp.
807 Edgewater Rd., New York 59, N. Y.
Randolph Products Co.
92 N. 12th St., Carlstadt, N. J.
Rapid Electric Co. 11
2881 Middletown Rd., Bronx 61, N. Y.
Raybestos-Manhattan, Inc. Manhattan Rubber Div. 88
Passaic, N. J.
Reynolds Chemical Products Co.
1200 N. Main St., Ann Arbor, Mich.
Robertshaw Fulton Controls Co., Fulton Sylphon Div.
Knoxville 1, Tenn.
Rona Laboratories, Inc.
E. 21st & E. 22nd Sts., Bayonne 3, N. J.
Sandox, Inc.
61 Van Dam St., New York 13, N. Y.
Saran Lined Pipe Co. 29
2415 Burdette Ave., Ferndale 20, Mich.
Schori Process Div., FerroCo Corp.
8-11 43rd Rd., Long Island City, N. Y.
Sel-Rex Corp. 77, Inside Back Cover
75 River Rd., Nutley 10, N. J.
Service Screw Products Co.
131 N. Green St., Chicago 7, Ill.
Sethco Mfg. Co. 38
2286 Babylon Turnpike, Merrick, L. I., N. Y.
Siefen Co., J. J. 94
5643 Lauderdale, Detroit 9, Mich.
Selbern Mfg. Corp.
120 13th St., Brooklyn 15, N. Y.
Solvay Process Div., Allied Chemical Corp. 15
61 Broadway, New York 6, N. Y.
Solvents Recovery Service 102
1025 Broad St., Newark 2, N. J.
Sommers Bros. Mfg. Co. 100
3439 No. Broadway, St. Louis 7, Mo.
Spee Flo Mfg. Corp.
6614 Harrisburg, Houston 11, Texas
Stevens, Inc., Frederic B. 25
1808 - 18th St., Detroit 16, Mich.
Stokes Corp., F. J.
5500 Tabor Rd., Philadelphia 20, Pa.
Storts Welding Co., Inc. 94
38 Stone St., Meriden, Conn.
Stutz Co., The 103
4430 W. Carroll Ave., Chicago 24, Ill.
Surety Rubber Co.
Carrollton, Ohio
Syntron Co.
Homer City, Pa.
Technic, Inc. 41
39 Snow St., Providence, R. I.
Timesavers, Inc.
Box 7446, Robinsdale Station, Minneapolis 22, Minn.
Tranter Mfg., Inc.
Lansing 9, Mich.
True Brite Chemical Products Co. 98
P. O. Box 31, Oakville, Conn.
Udylite Corp., The 18, 19
Detroit 11, Mich.
Unit Process Assemblies, Inc. 101
61 East 4th St., New York 3, N. Y.
U. S. Galvanizing & Plating Equipment Corp.
31 Heyward St., Brooklyn 11, N. Y.
U. S. Stoneware
Akron 9, Ohio
Univertical Foundry & Machine Co. 95
14841 Meyers Rd., Detroit 27, Mich.
Victor Chemical Works
155 No. Wacker Dr., Chicago 6, Ill.
Werkton, Inc.
253 W. 28th St., New York, N. Y.
Worthy Products Co. 116
Box 123, Temple, Pa.
Wright Metalcoaters, Inc.
255 West St., So. Hackensack, N. J.
Wyandotte Chemicals Corp. 21
Wyandotte, Mich.
Zialite Corp.
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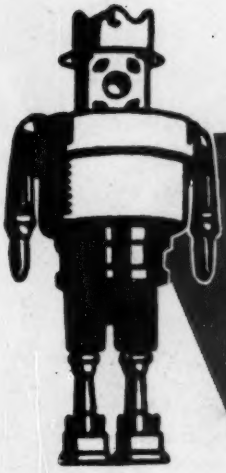
Another plating problem solved by Sel-Rex

"SEL-REX GOLD PLATE ELIMINATED GALLING, INCREASED RESISTANCE TO WEAR OF OUR CONNECTORS."



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ELECTRONIC COMPONENTS

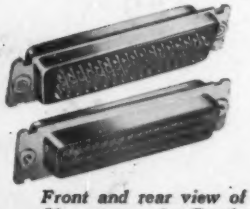
THE PROPOSITION: Research proved that *some* of the metallurgical properties of Gold would improve performance and reliability of new Cinch Connectors.

THE PROBLEM: Ordinary Gold plate's softness makes it susceptible to galling. And, because it is so soft and relatively porous, it wears readily exposing vital contact points to abrasive damage, corrosion —early failure.

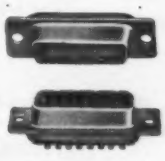
THE SOLUTION: After extensive investigation, Cinch installed Sel-Rex Bright Gold because this patented formulation produces electroplate which is:
1)...twice as hard (115 Vickers, as compared to 65) and has demonstrated 40% greater resistance to wear and abrasion.
2)...far more dense — accelerated corrosion tests prove Sel-Rex Bright Gold plate gives many times more protection with a fraction of the Gold.
3)...mirror-bright in any thickness, directly from the bath—no scratch brushing or burnishing. Eliminating such costly post-plating operations makes *net costs* lower too.

Exclusive Sel-Rex Plating Processes retain the desirable properties of the precious metals — eliminate the problems.

Whatever your plating problems — precious metals, power, equipment or procedures — Sel-Rex representatives are trained to engineer solutions to our mutual profit. Send for FREE technical literature and other case histories and see for yourself...we may have solved your problems last month.



Front and rear view of 50 contact socket D sub-miniature series with floating mounting holes.



15 contact plug and socket D sub-miniature series.

23 contact plug and socket DPX series.

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of the Holiday Season

"Lang May Your Lum Reek"

. . . May your holidays be joyful, your New Year filled with happiness, success and prosperity.

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